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1948 Factory Report

We are pleased to note that the Report of the Chief Inspector of Factories for 1948 is published somewhat earlier than has been the case in recent years. This is all to the good, as speed in production always enhances the value of statistics. Of accidents of a non-fatal character, there were 400 fewer in the foundry industry in 1948, but unhappily there was an increase of two in the number of fatalities. The actual statistics relating to the years 1945 to 1948 are:—*Non-fatal accidents,* 11,947; 13,225; 12,884, and 12,482; *fatal accidents,* 36; 31; 27 and 29. The figures for the last two years follow the general trend for all industries. There is a hint that ex-commando soldiers take more risks than other types and therefore require greater supervision in the formative period as industrial workers. There are still too many accidents recorded from burns, fragments entering the eyes and from falling bodies. These three factors need the energetic attention of everybody within the industry. The incidence of pneumoconiosis amongst sand blasters and steel dressers is unchanged at 5 and 13 cases respectively.

No fewer than 7½ pages are devoted to iron-foundries, which are initially divided into four groups. The industry should take special note of this, for it may mean future legislation by groups. It is obvious from a perusal of this section that the Factory Department, being composed of realists, knows that some of the proposals now before the industry are totally inapplicable to the smaller fry. In a summary, the district inspectors have dealt with the various sections of the "Garrett" Report. On the question of cleanliness, there is no enthusiasm shown for vacuum cleaners, unless there is a discharge to the exterior of the building. This is because the air leaving the cleaner contains the most dangerous particles of the dust. The inspectorate likes concrete floors, where possible, but many foundrymen do not, finding them slippery and dangerous if liquid metal be spilled. There is something in this assertion of slipperiness, especially when small pellets of metal are present. So far as good housekeeping is concerned, it seems the larger foundries are quite good, whilst the smaller ones leave much to be desired. Personal experience cannot altogether confirm this, taking into consideration the difference in methods of working. It is more difficult to keep a farmhouse kitchen tidy than one attached to a works canteen. In dealing with over-metal, the summary states that "suitable receptacles are provided in the larger foundries," yet our impression is that this is now general practice. The case of a rotatable over-metal mould is cited, but not the one where a conveyor is in operation to take the pigs up to the furnace charging platform. Under the caption of "temperature," it is reported that slow-combustion stoves are gradually replacing the open fires, and it is admitted that the maintenance of good ventilation and adequate temperature is often very difficult. The men, it seems, have quite an affection for the open coke fire. The comment on lighting is that the electric-light fittings are seldom kept clean, whilst glare has been noticed in the smaller concerns. It is obvious that the industry is progressing in the direction of providing improved washing and bathing facilities, but it is being handicapped by the hundred-and-one building regulations. Lockers for clothes are not popular amongst operatives unless they can be located very near to the work places. We were pleased to receive confirmation of our assertion that there are virtually no offensive fumes from core binders of the type normally used.

We are always intrigued in studying Factory Reports with the way the compilers suddenly pick out one case, which is, on occasion, cited as being an exception. It may be that there is such a tradition of "teaching" amongst the inspectors, that they allow this attitude to colour this annual report. To our mind, it would be more logical to confine attention to the typical, or at least large groups, and to omit "in one case" citations. An impression received from this report is that the employers are a good deal more enthusiastic about the "Garrett" Report than the workpeople.

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Film Reviews

"Casting in Iron" and "Blast Furnace"

The Press were invited last Tuesday by British Instructional Films Limited, in conjunction with Associated British-Pathé, Limited, of Film House, Wardour Street, to see two "sound" films:—"Casting in Iron" and "Blast Furnace." Both these as silent versions have previously been reviewed in the JOURNAL. The second film contains in the commentary a bad fault, as the working temperature of the hot-blast stoves is given as 2,000 deg. C. instead of 1,000 deg. C. In the first, we noted a tendency to mispronounce the word "cupola." This poses the question as to whether it is preferable for the professional commentator to become a technician or a technician to acquire the art of the commentator. The latter suggestion might be worth trying. There was a comment from one of our colleagues of the Press, that a mechanised system of manufacture should be shown, but from a boy's point of view, it would fail to answer the question: "Where do I come in?" The producers were right to show the making of a job completely devoid of complications. In addition to the films, the Press were shown the film strips which accompany them. The shots have been well selected, and if they are shown after the main film, the audience receives the impression that they are no longer "stills," for mentally the movement still persists, and naturally adds to their interest and usefulness. This makes more urgent the production of sound films to cover the "Open-hearth Furnace" and "Electric-arc Induction Furnaces," for which processes film strips and lecture notes are now available.

World Power Conference

The provisional programme for the World Power Conference, which is to be held in London from July 10 to 15, 1950, has recently been published. Listed are over 150 Papers (23 from this country), and details are included of a number of scheduled post-conference tours. Each tour lasts about a week, and commences on July 17.

The theme of the Conference, which is the first plenary session since 1936, is "World Energy Resources and the Production of Power." The Papers have been prepared by recognised experts in their own national spheres and are included under three groups: I, Energy Resources and Power Developments (these are individual national committee reports); II, Preparation of Fuels, and III, Production of Power.

Copies of the programme, further technical details of the Papers, and application forms to join the Conference may be obtained from the offices at 414, Cecil Chambers, 76/86, Strand, London, W.C.2.

Dinner and Dance

Institute of British Foundrymen London Branch

Mr. F. Arnold Wilson presided over a large gathering of members and their ladies at the annual dinner and dance of the London Branch of the Institute of British Foundrymen. The guests included Mr. Noel Newman, J.P., and Mrs. Newman; the Master of Worshipful Company of Founders (Mr. A. P. L. Blaxter, M.A.) and Mrs. Blaxter; Mr. Colin Gresty and Mrs. Gresty; Mr. G. Judd, C.A., and Mrs. Judd, and Mr. T. Makemson, M.B.E. The organisation was successfully carried through by Mr. W. G. Mochrie and Mr. A. R. Wizard.

Forthcoming Events

JANUARY 10.

Institute of British Foundrymen.

Coventry Students' Section:—"Magnesium Founding in Theory and Practice" by J. H. Partridge, at Coventry Technical College, at 7.15 p.m.

Institution of Works Managers.

Leicester Branch:—"Foremanship," by Capt. L. S. Saunders, at the British Thomson-Houston Company, Limited, Rugby, at 7 p.m.

JANUARY 11.

Institute of British Foundrymen.

Sheffield Branch:—Discussion on "Productivity," opened by the Steel Founding Productivity Team, at the canteen of Samuel Osborn & Company, Limited, Mushet Works, Penistone Road, Sheffield.

Birmingham Students' Section:—"Control and Measurement of Casting Fluidity," by V. Kondic, Ph.D., B.Sc., at the Chamber of Commerce, Birmingham, at 7.15 p.m.

Lancashire Branch:—"Film, "Bronze Founding," at the Engineers' Club, Albert Square, Manchester, at 7 p.m.

Institute of Vitreous Enamellers.

Southern Section:—"De-enamelling," by B. B. Kent, at the Howard Hotel, Norfolk Street, Strand, London, W.C.2, at 7 p.m.

JANUARY 12.

Institute of British Foundrymen.

Lincolnshire Branch:—"Some Coremaking Problems," by J. F. Barnes, at the Lincoln Technical College, at 7.15 p.m.

Institution of Production Engineers.

Halifax Graduate Section:—"Metal Spraying," by W. Wall, at the Halifax Municipal Technical College, Halifax, at 7 p.m.

JANUARY 13.

Institute of British Foundrymen.

Middlesbrough Branch:—Visit to Dorman Long & Company, Limited.

Institution of Production Engineers.

Eastern Counties Section:—"Industrial Applications of the Lost-wax Process," by A. Short, A.M.I.P.E., at the Lecture Hall, Electric House, Ipswich, at 7.30 p.m.

Huddersfield Engineering Society.

"Lifting Machines and Tackle," by C. Clarke, at the Lecture Room, Electricity Showrooms, Market Street, Huddersfield.

JANUARY 14.

Institute of British Foundrymen.

Newcastle Branch:—Branch President's Night, at the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6 p.m.

Scottish Branch:—"The making of Small and Medium Iron Castings on a Semi-Mechanised Plant," by David Kinnon, at the Royal Technical College, George Street, Glasgow, at 3 p.m.

Forty Years Ago

In our issue of January, 1910, it was announced that the Master Warden and Court of Assistants of the Worshipful Company of Founders were staging an exhibition of castings in the following June. Money prizes, medals and certificates were to be awarded. There was a long article on moulding machines and, in connection with this, there was an illustration of the foundry of Julius Pinch of Berlin, which, with the introduction of a few conveyors, would pass for a present-day plant. It was not easy in those days to sell moulding machines, for a claim by one firm that their machine would turn out 100 castings for radiator tubes per day, using three men, was nullified by the statement of a foundry manager that without machines three of his men made 116 *per diem*.

Pattern Equipment for Production Moulding*

By S. A. Horton

The fundamentals of pattern construction are first reviewed and then practical applications are dealt with, emphasis being placed on the special requirements for quality production and for high-accuracy moulding. Finally, there is a detailed account of many aspects of core-blowing practice. The Author is a past-president of the East Midlands branch of the Institute of British Foundrymen.

A MAJOR development of foundry practice during recent years has been the extended use of moulding machines whereby some, or all, of the operations are performed mechanically, thus eliminating hard labour to a greater or less extent; to meet the changed state of affairs, a specialised type of patternmaking has been created. Because foundries have individual layouts and have installed varying types of equipment, the production of a particular casting may be a slightly different problem to each particular foundry, but without exception the pattern equipment must be made to produce castings by the most economical method applicable to the conditions operating in the foundry in question.

It is not intended to define rules to be followed when designing pattern equipment, but rather to attempt to give details of methods which have been successfully applied in the planning and preparation of pattern equipment for use in production foundries. It must be appreciated that the pattern equipment is essentially a moulding tool, and must therefore be planned by the foundry executives in consultation with the pattern shop. A brief *resumé* of the points to be discussed following the receipt of an enquiry will be of interest. They are (1) size and weight of the casting; (2) quantity required; (3) is the casting as designed a practical production moulding possibility?; (4) the parting line may be established and the position of feeders and runners determined; (5) what type of moulding machine is to be used?; (6) what number of patterns is required relative to the moulding-box size and quantity available, and (7) what number of cores is required.

Casting Design

It must be appreciated that the founder desires to produce castings which conform to the limits imposed by precision-machining practice, and is continually studying methods by which this objective can be achieved. There is, however, need for greater appreciation by the designer and engineer of the founder's problems, and much could be done to assist in the production of sound and cheaper castings by intelligent co-operation.

Many castings as originally designed are difficult to produce whereas the founder's knowledge and past experience enables him to suggest modifications to the design which facilitate production without impairing the efficiency of the casting in service, but unfortunately, too often, the proffered assistance is indifferently received.

The inclusion of more information on the drawing would be of great assistance. For example—dimensions where the black casting must be within close tolerances could be indicated. The points from which the casting will be located for machining operations should be shown, and the nature of the machining operation stated. It is now general practice for large consumers of castings to submit designs for consideration before the final approval is sanctioned; this co-operation is usually followed by a solution of many foundry problems to mutual satisfaction.

When the modification to a submitted design is required, the following points are worthy of attention:—(1) will the modification reduce production costs; (2) will the percentage of scrap be lowered; (3) will it adversely affect the machine-shop costs, and (4) will the utility or appearance of the casting be impaired. With these points satisfactorily answered, the modification can be put forward with confidence. Mutual co-operation will repay all concerned, as for instance, with a combined hub and brake drum, as designed, a core may be required on the outside of the hub section yet modification has on occasion eliminated this core and cheapened production costs. Again, a lamp bracket has had its design modified so as to enable castings to be produced without a core.

Differential Case.

With the differential case casting shown in Fig. 1, the modified design in the top half of the sectional view eliminates the necessity for the core around the outside of the casting to form the lightening-out recess, and this lightening-out is successfully obtained by an alteration in shape to the centre core.

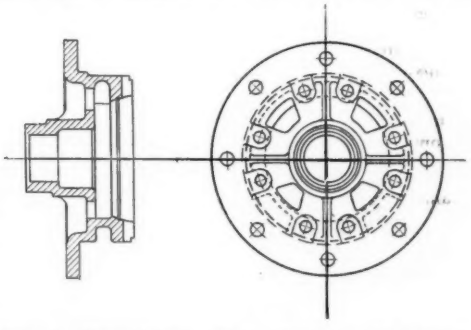

FIG. 1.—DIFFERENTIAL CASE CASTING. THE LOWER HALF OF THE SECTIONAL VIEW IS THE ORIGINAL DESIGN, AND THE UPPER HALF SHOWS THE APPROVED MODIFICATION.

*A Paper read before the Lancashire Branch of the Institute of British Foundrymen, Mr. R. L. Handley presiding.

Pattern Equipment

Differential Carrier

A differential carrier is an excellent example for illustrating the beneficial results to be obtained by intelligent co-operation between the engineering design department of an automobile company and the foundry. The design as submitted necessitated the whole of the internal shape being formed by a dry-sand core, due to the position of the two main bearings. After consideration, it was apparent an even metal section could be retained if the design of the bearings was modified; the inside shape could then be moulded in green sand which would eliminate the possibility of casting pulls and cheapen production costs.

Rear Hub (commercial vehicle)

Fig. 2 shows that as designed, a large core was

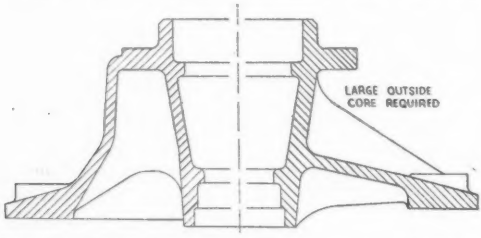

FIG. 2.—REAR HUB CASTING. RIGHT-HAND SIDE OF THE CENTRE LINE AS ORIGINALLY DESIGNED. LEFT-HAND SIDE SHOWS APPROVED MODIFICATION.

required to form the casting shape between the two flanges of a rear hub casting for a commercial vehicle. After modification, no core was required because the casting body could then be moulded in green sand.

Types of Equipment Required

The production of a sound casting is the result of intelligent foresight; the design and position of all runners and feeders must have prior consideration, this being essentially a foundry decision. With these considerations established, the size, weight and quantity requirements of the castings influence the decision as to the type of pattern equipment to be produced.

Competitive casting cost must be the deciding factor, as the pattern costs are usually a small part of the overall cost statement, therefore a set of pattern equipment which will readily mould using the equipment to hand should be produced. The number of patterns required is dependent on the moulding machine available, and the moulding-box sizes which for cope and drag vary between:—

15 in. by 12 in. by 4, 6, 8 or 9 in. deep.
30 in. by 21 in. by 11 in. deep.

Intermediate sizes being:—

17 in. by 13 in. by 4, 6, 8 or 9 in. deep.
17 in. by 17 in. by 6 or 7 in. deep.
20 in. by 20 in. by 7 or 10 in. deep.
24 in. by 20 in. by 6 or 10 in. deep.

The foregoing points having been decided, the pattern shop are instructed to prepare the necessary equipment and guidance as given on the following lines:—(1) Type of pattern; (2) number of patterns required; (3) material from which they are to be produced; and (4) the pattern joint is marked on the drawing, also the number and position of all cores; an indication is given if core sets will be required.

Two types of patterns are generally used for production moulding, *i.e.*:—

Match-plate Patterns

These consist of pattern plates with part of the pattern on each plate, either cast as an integral unit, or made by mounting the half patterns on suitable pattern plates, as shown in Fig. 3.

Cope-and-drag Patterns

These consist of half patterns mounted on twin pattern plates and give the advantage of producing both half moulds simultaneously, the two parts being in perfect alignment and mould partings being formed by the pattern plates. These make excellent equipment for quantity production, and are shown in Fig. 4.

Preparation of the Pattern Equipment

Efficiently-made pattern equipment is essential for rapid mould production, and it is the responsibility of the pattern department to prepare such equipment and, of necessity, to control its cost. However, it must be appreciated that it is in the foundry that the worth of the equipment is proved, and the cheapest and simplest equipment does not necessarily result in efficient or economical mould production.

Experienced patternmakers are familiar with the fact that the usual contraction allowances cannot be applied universally to all types and shapes of castings.

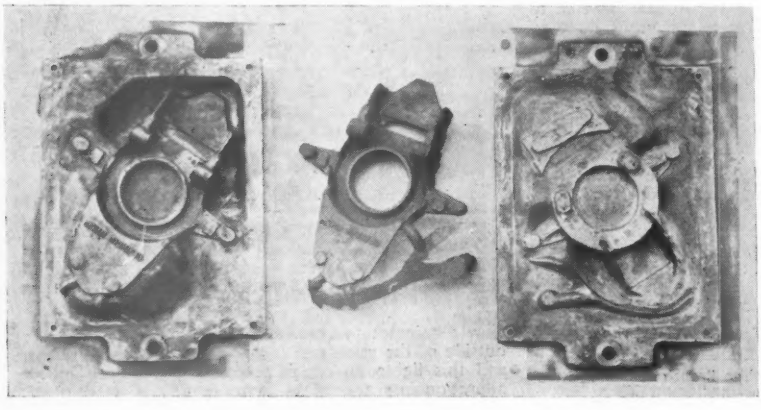

FIG. 3.—CAST-ALUMINIUM PATTERN-PLATES WITH HALF PATTERN ON EACH PLATE. THE CASTING IS SHOWN IN THE CENTRE.

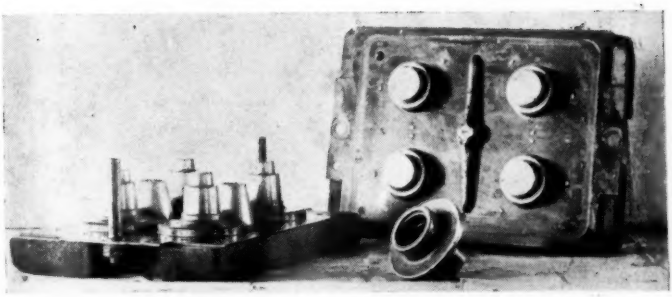

FIG. 4.—TWIN PATTERN-PLATE EQUIPMENT AND A CASTING.

Obviously this is a form of knowledge that can be acquired only by an intelligent study and long practical experience, but this knowledge correctly applied in the preparation of working pattern equipment is a very important feature.

It is an established practice in the Author's pattern department for the "wood" and "metal" shops to be self-contained. By this arrangement a double check on all work is obtained. The master-pattern equipment, being prepared in the wood shop, after checking, is passed to the pattern foundry for the metal patterns to be prepared, the resultant castings then being passed to the metal shop.

The first operation performed by the metal pattern-maker is to mark out completely the rough metal-pattern casting and metal core boxes, establishing all datum lines for subsequent machining or hand-tool working, and checking all machining allowances before ultimately accepting the castings as being suitable for the preparation of the final working-pattern equipment.

By this practice the accuracy of the work performed by the "wood" shop is checked, and the possibility of a mistake on the master pattern being duplicated on the metal equipment is eliminated. In the event of a mistake on the finished metal pattern, this is invariably found at the marking-out of a sample casting, which is cast to prove the suitability of the working-pattern equipment before it is issued to the foundry.

Extreme accuracy is maintained in all phases in the preparation of the metal-pattern equipment, and the use of precision machines is now accepted practice, and operations which a few years ago were carried out by hand tools are now performed by the machine, resulting in improved accuracy. The number of patterns mounted on the pattern plates of course varies, depending upon the over-all size of the desired casting, but up to 40 patterns have been mounted on a pattern plate for a 15 by 12 in. moulding-box. In addition, there must be incorporated suitable runners and feeders and it is essential for all similar patterns to be interchangeable as regards all dimensions.

Working patterns are usually prepared in pairs or multiples of two; in this way balanced feeding and running is maintained. Individual metal production patterns and core boxes are generally cast from a master pattern or core box such as are shown in Fig. 5, made of either yellow pine or plaster of paris. Providing the casting is straightforward in design, the master pattern can be prepared in the usual manner, but if there are sections which will not mould, the following method is used:—

The master pattern is prepared exactly as shown on the drawing, the actual moulding of the pattern being disregarded. When completed, the sections which will not mould are noted, and plaster casts are made of these undercut sections, sufficient material being allowed to permit the forming of suitable core prints. The plaster cast, when set, is removed, and worked to the desired shape. The plaster cast to the shape of the undercut section and the core print is now used as a pattern in the preparation of the master core box from which the metal production core box will be made. When this has been completed, the original plaster cast is then re-secured to the master pattern to form its necessary core print. This method of making plaster core prints and core boxes from plaster casts (shown in Fig. 6) eliminates errors which might be caused by the "green" mould and core not registering correctly when the master pattern and master core box are prepared independently from templates. Whenever possible, metal working-patterns are prepared by a series of machining operations; this procedure reduces hand tooling to a minimum and eliminates errors such as variation of metal sections in the casting through patterns and core box not being symmetrical (Figs. 7 and 8).

Whatever the contour of the pattern or patterns at the mould joint the shape is developed into a perfectly

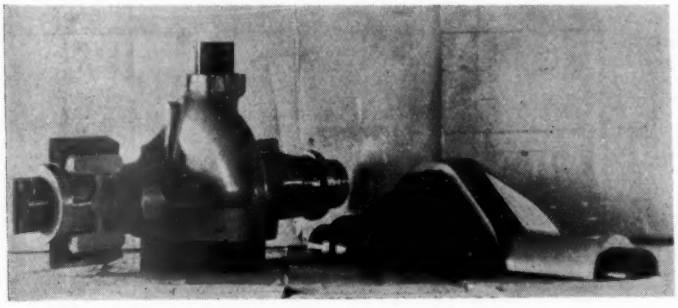

FIG. 5.—PINE MASTER-PATTERN EQUIPMENT; THE CORE PRINTS BENEATH THE SPRING BRACKET ARE FORMED FROM PLASTER CASTS.

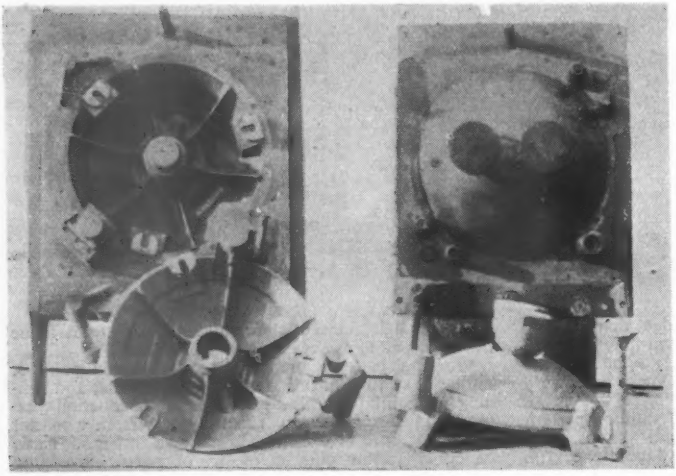

FIG. 6.—MOULDING EQUIPMENT AND CASTING FOR WHICH UNDERCUTS FOR THE METAL PATTERNS WERE PRODUCED FROM PLASTER AND USED TO MAKE CORE BOXES. THESE PLASTER PIECES WERE THEN REPLACED FOR CASTING THE FINAL PATTERN.

flat joint at the internal edge of the moulding box joint, to permit the use of standard box parts, and in several instances this practice has given the pattern-maker scope for originality in setting-out the pattern equipment before mounting it on the pattern plate. It is always desirable to locate all cores in the drag. In some instances this is impossible, but this feature also introduces scope for development by the patternmaker.

The mounting of the working patterns on pattern plates is a part of the preparatory work which demands accurate machining. Pattern plates are always prepared face-to-face, and when suitably machined, one plate is turned to the right hand and the patterns mounted on the faces that have been in contact during the course of preparation. The actual location of each half pattern is either by dowels which pass completely through the pattern or by dowels integral with the pattern, which have been turned to a suitable diameter. All patterns are secured to the pattern plates either by bolts or set screws from the underside of the pattern plates, if at all possible, thus eliminating marks on the moulding surface of the pattern. All pattern plates are perfectly flat, and are either rolled-steel, case-hardened plates $\frac{3}{16}$ in. thick, or cast-iron plates, machined on both faces, 1 in. thick. Aluminium cast plates are usually $\frac{1}{4}$ in. thick but the thickness can be modified to suit the requirements of the pattern, which is to be mounted on the plate. A half mould for an aluminium cast plate is shown in Fig. 9.

As the Author is not considering foundry problems, no reference will be made to location of runners and feeders. These are designed by the foundry and attached to the equipment in the pattern shop, and are therefore considered an integral part of the pattern equipment.

Quantity-production machining necessitates a casting being machined from predetermined jigging points, therefore it is imperative for the cored portion of the casting to be in correct relation to the mould portion. To ensure this uniformity, the right type of core print is essential. It is the Author's practice for the core print and core box to be prepared of exactly the same size, the pattern and core-box vibration or rapping being sufficient to permit clearance for correct assembly.

When a series of cores are supplied to the moulder in an assembled condition, they are checked before leav-

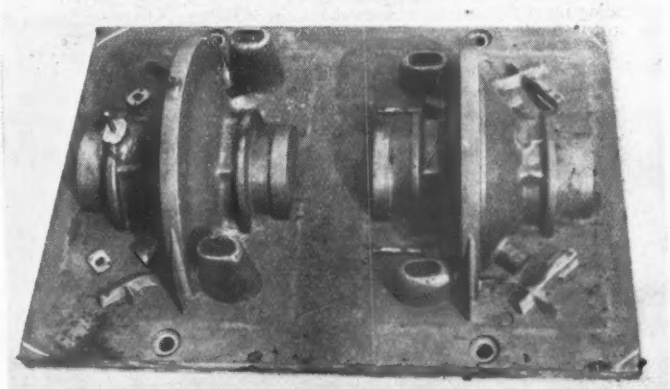

FIG. 7.—ROAD-WHEEL HUB. BRASS PATTERNS TO FORM COPE AND DRAG HALF MOULDS, MOUNTED ON A SINGLE PATTERN PLATE. THE PATTERN WAS PREPARED COMPLETELY ON POWER-DRIVEN MACHINES.

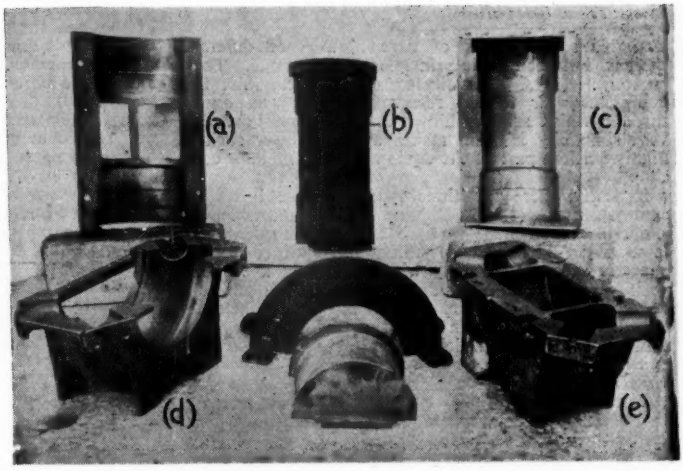

FIG. 8.—ROAD-WHEEL HUB CORE BOXES.
(*a*) Core carrier for the centre core. (*b*) Two cores and the carrier for the body core. (*c*) Cast-iron half core box for centre core. (*d*) Core jig for dressing the body core to make an exact half. (*e*) Cast-iron half core box for body core.

ing the core shop. The checking gauges used for this purpose are prepared in the pattern shop, as are also the gauges used for checking the cores after assembly in the mould.

Dimensional Accuracy and General Finish of the Casting

All foundrymen are aware of the high standard demanded by the average machine-shop inspection department. To fulfil the necessary requirements, rough castings must conform to the drawing dimensions within extremely close limits. The point it is desirable to emphasise is that, although a pattern may be correct to drawing and be prepared for moulding in what is thought to be a satisfactory manner, machinable castings arfe not always obtained. For the purpose of this Paper, a machinable casting is one which will locate in the various pre-determined location points of the tooling equpment, designed for the machining of this particular casting, and be correct to drawing when the machining operations are completed.

The point to be stressed can best be illustrated by explaining the difficulties experienced with steering-box castings. The foundry were requested to produce these castings, but the jig locations were not shown on the drawing from which the pattern equipment was produced. It was decided to joint the pattern through the centre-line of the main bore; the section beneath the quadrant-arm casing was cored-out, and when completed, four patterns were mounted on twin pattern plates and were satisfactory from the moulding point of view. The castings produced were quite a good job, and considered to be of standard finish. However, when machining operations commenced, it was stated that no two castings were alike, and that if machining operations were continued, the machining rejections would be abnormally high.

The method of machining was as follows:—The machine table had six stations, on each being mounted a casting-location jig, on which the castings were placed. In operating the machine, the stations revolved and made six stops in one complete revolution, at each stop a set machining operation being performed. When a casting had made one revolution of the machine, the whole of the machining operations were complete. From this description of the machining equipment and operations, it will be understood that the castings have to be extremely accurate and consistent in general shape.

On the first machining run, 25 per cent. of castings were rejected, as the main or trunnion bore failed to clean up. In an endeavour to check this high-rejection figure, the patterns were inspected and found to be correct. Fixtures similar to the machine jigs were then made to gauge the positions of the two bores in relation to the jigging points. It was proved that slight swells on the trunnion (which stood vertical in the mould) caused either by variation in ramming, tendency towards cross-joint at the main bore location, or a slight misplacement of the core beneath the quadrant-arm casing, adversely affected the machine jigging, because each of these points contacted the jig. With these three potential errors controlled from the foundry point of view, the machining rejections were reduced to 10 per cent.; this was not considered satisfactory, and the whole position was reviewed by the foundry executive, who decided to prepare new pattern equipment.

The new equipment was again jointed on the main-bore centre-line, but at 90 deg. to the first pattern. It will be realised that all three points of location were now in the drag, so the possibility of a cross-joint affecting the main bore location was eliminated, the trunnion was now horizontal in the mould, and no core was required beneath the quadrant-arm casing. The castings from this equipment have given complete satisfaction, the scrap due to bores not cleaning-up ceased, and material defects are at present the only cause of machine shop rejections. Had a little more relevant information regarding casting-jigging points been given on the drawing, it is quite possible that satisfactory castings might have been produced from the very commencement of the order.

Coreboxes for Core-blowing Machines

Quantity production of cores by the use of core-blowing machines is now recognised as standard procedure; the design and construction of suitable metal core boxes is a vital step in the making of good-quality cores. In principle, cores are blown by introducing sand into the core box cavities by means of a stream of air, in which sand grains are suspended. There are

Pattern Equipment

available several types of core blowers of different designs, but their basic principles are the same. They embody:—(1) A reservoir for sand; (2) an inlet for compressed air to the reservoir, and (3) an outlet through which sand is blown into the core box. Its very simplicity is what makes a core blower such a highly-efficient part of the equipment of a modern core shop.

Basically, there are three types of core boxes in common use:—(1) The "lump" core box which is a one-piece box made to blow and draw through the same end; (2) the two- or three-part, split core box, open at each end, usually with parting in a vertical position, the cores being dried in the on-end position on a flat core plate, and (3) the completely-enclosed core box, usually blown with the parting in a horizontal position, from which the green core is transferred to a carrier.

Materials Used.

Core boxes are usually constructed of cast iron or aluminium; both materials possess characteristics which should be given consideration. Cast iron is highly resistant to wear, relatively costly to construct, comparatively heavy to handle, but is more permanent, and has general usefulness where the box will not be too ponderous and the cost of preparation is not exorbitant.

In cases where the core-box sizes are larger and the nature of the core requires intricate and extensive machine work, aluminium is the material usually selected. It is light and easily worked, but is subject to more rapid wear. Therefore, it is no common practice when making aluminium core boxes to protect wearing surfaces—with steel bushings in the blowing holes, steel wearing plates on joint and clamping surfaces, and replaceable steel inserts at other points subject to excessive wear.

General Construction.—The general shape of any core box is controlled by the shape of the cavity or group of cavities. The box should not be made too weighty, yet it must withstand blowing pressure without distortion. The main ribbing around the outside of the box should follow the general contour of the cavity. This brings the pressure of the clamping action of the blower close to the cavity edge, assuring a tight seal at the core-box parting. It is general practice to make small core boxes square or rectangular in shape, with suitable ribbing; this is important, and consideration should be given when designing the shape of the box so that pressure from the ribbing is applied directly above the cavity outline. It has been proved that correctly-designed ribbing will add greatly to the life of the core-box parting.

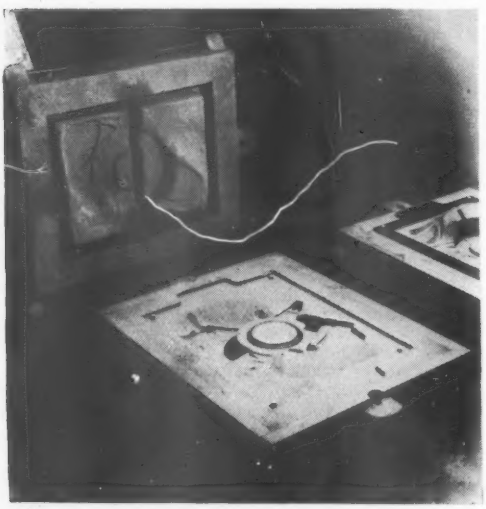

FIG. 9.—HALF MOULD FOR MAKING A CAST-ALUMINIUM PATTERN PLATE.

Locating the core box under the blowing head so that the holes in the blow-plate line up with the holes in the box can be done in several ways. The use of stops either on the machine table or under the box, or directly on the blow-plate, seems to be the general practice. Where the cavity shape permits making a box square or rectangular, no additional provisions are necessary. Maximum production facilities must be provided for the operation to handle the box quickly, and the provision of finger grips on the outside of the box enables the operator to grip and slide the box quickly under and away from the blower.

Whilst the introduction of sand into the core-box cavity can be controlled definitely by the size and location of the blowing hole, the flow of sand in the cavity itself is largely influenced by the size and location of the vents. As no two core boxes are quite alike, it is therefore impossible to formulate rules for blowing and venting, but it should be remembered that: (*a*) sand does not flow easily around sharp corners or through irregular or restricted passages, and (*b*) all air introduced through the blow holes must eventually be exhausted from the core, consequently the combined venting area, plus leakage (if any), must be equal to, or a little greater than, the combined area of the blowing holes. The blowing-hole bushes are made of case-hardened steel; they are made to protrude into the cavity slightly and have a thread in the lower end, so that the sand left in the blow hole will not draw out with, and become a part of, the core.

Venting.—Provision for the return of the air to the atmosphere can be arranged by different methods. As the ultimate purpose of a vent is to provide an outlet for the air, and at the same time to resist the passage of sand, it is sometimes possible to blow simple cores with no vents other than natural leakage at the joint face. A second method involves the machining of a series of very fine vee gates, approximately 0·005 in. deep, in the steel face of the core-box joint and leading from the core cavity to the outer face. A third method is to grind a step 0·005 in. deep one inch wide around the periphery of the core, and then to drill a series of holes $\frac{1}{32}$ in. diam. from the outer edge of this step to the outside of the core box, again in the steel facing of the core box joint. Yet another method is by using "breathers," or air vents. The two best-known types are the mesh construction and the slatted construction, each of which has individual merit under certain conditions. On intricate and difficult jobs where these commercial vents are not adequate, special treatment is required in the way of blowing-plate venting. When grooves or slat vents are used on the joint face, it is advisable for a common outlet to be designed, and this must not extend over the entire width of the joint face. If possible, it should be arranged that at least one short and abrupt change in direction of the stream of exhausted air be made. This retards the velocity of the sand particles without materially affecting the passage of air, and consequently reduces the cutting action of the sand on the core-box face. Fig. 10 shows two half-core boxes and a finished core made by blowing.

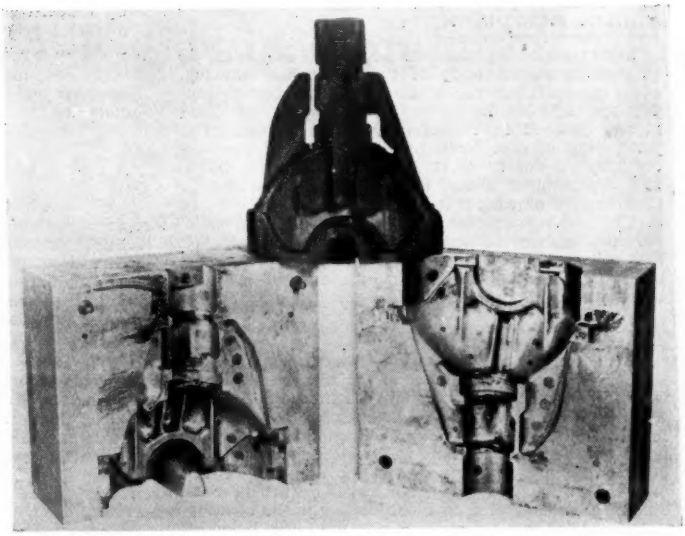

FIG. 10.—ALUMINIUM CORE BOX FOR CORE BLOWING. NOTE THE WIDTH ALLOWED FROM CORE CAVITY TO THE OUTSIDE OF THE BOX AND THE PERFECT FITTING OF LOOSE PIECES. SLAT-TYPE VENTS ARE USED.

It is desirable to have as few vents as may be necessary, but, contrary to natural assumption, when a blown core is soft or appears weak in certain places, it is often due to incorrectly placed or insufficient vents rather than to lack of blowing pressure. The size and number of blowing holes and the size and number of vents are closely related. The holes should be as few as practicable and be, usually, placed over or adjacent to the heavier sand sections or pockets of the core. Theoretically, when blowing a core, the operator replaces the air in the cavity with sand of the proper density. That has the effect of exhausting the air only through the vents provided and not through the parting of the box or through some other weak point.

Renewable Facings

The faster the sand enters the cavity the greater the impact, and therefore the harder the core. If a completely-enclosed box, without vents, were to be blown, the only place the air could escape would be through the parting. So it is preferable to over-vent than to under-vent for maximum life of core-box material at the parting.

There should be very little back pressure through the parting; the air should have a free flow through the vent area. The parting on an enclosed core box is usually the weakest point, and must be renewed wherever sand commences to escape. Steel seems to be the material most preferred for this purpose, though there are three factors to be considered when choosing a material for core-box facing:—

(1) It must maintain a good seal; (2) the edges must stand up to service conditions; and (3) the cost of the replacement must be related to the life. The thickness of the facing should be kept to a standard dimension so that when it is replaced, the original size of the box will be retained. Usually, the entire parting of the box is covered with facing. It is sometimes essential to form a baffle at the core-box joint to form an efficient seal.

The pressure of the clamping action must seal the box at the cavity edge, because if sand cannot get into the parting, it cannot cause abrasion of the facing material. In this respect, the marginal facing should be as wide as possible round the entire cavity to ensure uniform sealing round the edges and of pressure inside. To assist in securing a perfect seal without distorting the box, the steel facing at the joint should be surface ground. No facing material, regardless of its hardness or abrasion-resisting qualities will give satisfactory service unless a perfect seal is maintained during the blowing operation.

Other Constructional Details

It is always necessary on an aluminium core box to provide under the blow tubes inserts of steel or some other suitable material. The inserts vary in size depending on the service conditions and are constructed so as to be replaceable when worn out. On short-run jobs, the insert can be a small round piece recessed in, of a size large enough to cover the blast area.

The blower core box must be kept parallel on the clamping surface to ensure a good seal. For this reason, steel is used to prevent the box from wearing out of line. The bottom plate must stand the wear of sliding in and out of the blower, and the top plate must be heavy enough and be supported by ribbing underneath to prevent buckling. Interchangeability should be practised where at all possible, and every precaution should be taken to ensure long life and the prevention of excessive wear or abrasion action in the handling and blowing operations. Core boxes should be of a uniform over-all external depth so as to permit a series of different core boxes being blown in a sequence without alteration in the height of the blowing machine table.

Core Vents and Core Supports

A characteristic of a blown core is that the finer sand grains arrange themselves at the outside of the core with the larger sand grains in the centre. Consequently, a blown core has a skin of maximum smoothness and maximum permeability. Since such cores are more open than hand-rammed cores, they do not require as many vents. However, in some large cores it is desirable to vent, and the vent rods are built into the core-box equipment in such a manner as to permit withdrawal after the core has been blown.

Pattern Equipment

When reinforcing rods are necessary, they must be in position in the body of the core when blowing; posts are built into the lower half of the box to support the rods. In the finished core, the holes are filled in and patched either before or after baking. The positioning of core vents and reinforcement must be carefully considered in relation to the blowing holes, as the placing of a wire to form a vent immediately underneath a blowing hole may upset the whole balance of the blowing arrangements, with disastrous results. No core box for blown cores has yet been produced that will give maximum life and maximum production unless it is maintained. The maintenance of the core box is just as important as the designing or preparation.

Blowing Head

When using a sand reservoir which has a larger surface area at the bottom than the top, the tendency is for a tunnel to be formed through the body of sand when blowing, thus reducing the effective blowing area for the following blow. Should blowing be attempted under these conditions, there is a possibility of the core box not filling with sand, due to the tunnelling effect in the blowing head. This somewhat disturbing condition can be overcome by incorporating in the blowing head a metal insert to create a lead to the holes in the blowing plate, the purpose of the insert being to induce the remaining sand in the head to collapse over the blowing after each blowing operation.

A more efficient method is to blow a series of different cores in sequence under one blowing head from the same blowing plate, using different blowing holes. Employing this method, it is essential to use a blanking off plate on the top face of each core box, time is also saved by reduced changing of the blowing plate for different core boxes.

The selection of the number and size of the blowing holes depends entirely upon the core to be produced. A number of small holes $\frac{1}{4}$ to $\frac{1}{2}$ in. dia. are preferable to the use of one large hole, the advantage being that the small holes permit sand to enter the box under high pressure, which rapidly replaces the air; this is actually one of the fundamentals of core blowing. This system is of particular advantage in the production of large cores with off-set pockets as it permits blowing holes to be placed over these pockets.

Core-blowing Equipment Recommendations Summarised

The following summarised recommendations will assist in the preparation of satisfactory equipment for core production on a core blower:—

(1) Complete co-operation between the pattern shop and core shop is essential, so that design can be determined at the blue-print stage.

(2) Design of ribbing and general shape of the core box should be given careful thought.

(3) For maximum production, consideration should be given as to whether it is necessary to provide special features to enable operators to handle the box rapidly.

(4) Proper location and size of blowing holes and vents should be recognised as a means of prolonging the life of the core box.

(5) Attention should be given to the advisability of using a suitable metal as a parting material at the core box joint.

(6) When using light metals, provisions should be made to protect the area under the blowing hole by a wear-resisting insert, the life of which would be in direct proportion to the production requirements expected from the core box.

(7) For maximum production the core-blowing machine and accessories must be kept in first-class condition.

Core Carriers

A core is seldom more accurate than the carrier or plate which supports the green core; therefore, core carriers should be designed in such a manner as to resist distortion. If distortion occurs, they must be rectified or ruthlessly scrapped. No core should require dressing by the moulder before being placed in the mould and care should be taken during the core box preparation so that dressing is eliminated. All core prints should have suitable taper, particularly those in the cope, to make sure of closing the mould without fouling the core.

In conclusion the Author expresses his thanks to the directors of Ley's Malleable Castings Company, Limited, Derby, for permission to publish various shop practices, and to Mr. Marshall and Mr. Greatorex for their assistance in the preparation of the illustrations.

Vote of Thanks

MR. GALE proposed that a hearty vote of thanks be accorded to Mr. Horton for his extremely interesting and instructive Paper. It was an added pleasure to him to do so as he had been a colleague of Mr. Horton in the East Midlands branch for some 16 or 17 years. Knowing Mr. Horton so well he had been quite aware that the Lancashire Branch would have an excellent Paper presented to them. There was one point in connection with it which should be particularly stressed, namely the old question of co-operation between the engineer and foundryman. He held very strong views upon this matter. In his opinion, foundrymen were equally to blame with the engineers for the lack of co-operation. If the former would only go to the latter armed with some concrete proposals, they could be quite sure that the engineer would be ready to alter his design in order to more successfully complete a particular job.

MR. STOTT seconded the vote of thanks which was carried with acclamation.

Discussion of this Paper will shortly be published.

Special Lecture Course

The Sir John Cass College, Jewry Street, Aldgate, E.C.3, is organising through the Department of Chemistry a series of twelve lectures on Spectrochemical Analysis. The lectures are to be delivered by Mr. A. S. Nickelson, B.Sc.(Lond.), F.R.I.C., and Mr. A. R. Philpotts, M.A.(Cantab.).

The course, which will open with an introductory lecture by Dr. S. Judd Lewis, F.R.I.C., consists of weekly lectures on Friday evenings from 6 to 7 p.m., beginning on January 13, 1950, followed by ten periods of laboratory work for a strictly-limited number of students, on Fridays, 6 to 9 p.m., beginning on April 21. Enrolment for the laboratory course, which will be conducted by Mr. L. O. Freeman, M.Sc.(Lond.), will be arranged later. The subject will be treated mainly with reference to the practical problems of the chemist, and the lectures will be illustrated by lantern slides, photographs, charts, demonstrations, etc. The fee for the course is £1.

Casting a Large Pulley in Aluminium Alloy

By W. Wilson and A. Talbot

The discussion of this Paper at a meeting of the London Branch of the Institute of British Foundrymen brought out further important practical details concerning degasification of the alloy, melting procedures, costs, soundness and chilling. In addition, Mr. A. Talbot, whose flair for recruiting has previously been commented on in these columns, gave an account of his methods of attracting youths to the jobbing foundry and commented on the problems which were raised. The Paper was printed in the JOURNAL, *December* 29, 1949.

ON the occasion when the lecture, "Casting a Large Pulley in Aluminium Alloy" was given to the London branch of the Institute of British Foundrymen, Mr. E. Arnold Wilson, chairman, opened the proceedings by presenting a Diploma of the Institute to Mr. A. R. Wizard for his Paper on "Art Foundry Practice," read before the branch last session.

THE CHAIRMAN then introduced the lecturers for the evening, saying he was glad to see they had such a large attendance of members and visitors. The lecturers were being very well supported by their colleagues, and he thought it an extremely nice idea of the directorate of the Authors' firm (Western Foundries) to have arranged transport for any of the staff who wished to attend.

After reading a brief biography of Mr. W. Wilson and Mr. A. Talbot, Mr. Arnold Wilson said some time ago the branch council were invited to visit Western Foundries, and they had been extremely interested to find that it was a foundry in which there was actually a queue of young fellows who wanted to join the staff. That said a great deal for the way in which the establishment at Southall was run and it was, he thought, largely as a result of Mr. Talbot's activities. He hoped Mr. Talbot would tell them later on how he had created that happy state of affairs.

The Authors then presented their Paper, which was illustrated by lantern slides.

DISCUSSION

MR. A. R. WIZARD, opening the discussion, said it was a great pleasure to start the ball rolling, because he remembered visiting Western Foundries and seeing Mr. Wilson at work, and he thought perhaps that was the day when he was making his 6½-hr. melt. He had been extremely impressed by the way that Mr. Wilson and Mr. Talbot—whom he regarded as a tower of strength in Western Foundries' organisation—had laid out the whole job. He would like to know what life Mr. Wilson had obtained for the cast-iron basin when natural draught was used and he saved three hundredweight of coke. Did it last longer? Was that three hundredweight of coke worth saving, in view of hours of extra melting time? Perhaps, also, Mr. Wilson would give some idea of the cost of the iron melting basin which was made specially for the job.

MR. WILSON, dealing with these points, said that by stopping forced-draught melting they now had a bath which had given twelve heats and was not yet finished. Three hundredweight of coke was always valuable and there was no more labour incurred in melting by natural-draught melting. It was, in fact, easier to synchronise moulding and casting.

Comparative Costs

MR. L. G. BERESFORD (junior vice-president) said there were two things he would like to know. What was the comparative cost of that aluminium pulley as compared with the proposed cast-iron pulley? Secondly, he had understood Mr. Wilson to say that the furnace was in the open; what would he have done on a rainy day?

MR. WILSON said the answer to the first question was quite a simple one. Cast iron cost about 1d. to 1½d. per lb. Aluminium worked out at 10d. to 11d. per lb., so if they had the weight of the iron at 7,000 lb., there were over seven thousand pennies; and the aluminium casting was 3,600 lb., so there were over 3,600 tenpences or elevenpences! As to what would have happened if it had rained, they had been quite prepared for that; they had arranged in that event to run the ladle of metal into the shop and to de-gas and modify there.

MR. BERESFORD pointed out that Mr. Wilson had only dealt with the cost of the metal, but had not mentioned the total comparative costs as compared with cast iron (moulding, melting, etc.).

Mr. Wilson said that was not so simple a calculation. To melt 7,000 lb. of iron would work out at roughly 10 per cent. of the weight as coke. There was very little difference in the melting costs of iron and aluminium but, definitely, the metal cost would be of major importance.

MR. PIERCE said he noticed Mr. Wilson had briefly described the cast-iron bath by saying it was of "cast iron." Would he tell them whether it was ordinary cast iron, ordinary scrap, high-silicon iron, or any special composition?

He could not accept that the job in aluminium did not cost more to mould than the same job in cast iron. They would not use all those chills to produce a casting in iron. Finally, would Mr. Wilson give him an idea of the drop in temperature in the ladle over the period of 35 min. before pouring? He was interested in the actual pouring temperature. With reference to the statement that X-ray photographs were taken of the job, was he to understand that in that very large casting in 2L33 alloy there was no pin-hole porosity anywhere? He would have imagined that one would have been able to find some. However, he suggested, in a humorous sense, that if pin-hole porosity was definitely absent it was due to the fact that there was a pile driver outside the shop. Possibly this acted as a vibrator and helped in the elimination of porosity.

MR. WILSON, on the composition of the cast-iron bath, emphasised his opening remarks; theirs was a grey-iron foundry manufacturing castings for milk machinery and machine tools and the bath was cast in what iron was available at the time.

With regard to pouring, he was sorry he had not given the details. Tapping was at 720 deg. C.: the temperature dropped by approximately 40 deg. during the modifying and de-gassing and fell again over the 35 min. up to pouring. The casting was poured at 630 to 640 deg. C., which gave a total drop of about 80 deg.

Aluminium Pulley—Discussion

Dealing with the question of the pin-hole porosity, on one or two of the wheels there had been some very minor pin-hole porosity on the outer sections which disappeared on machining. The X-ray photographs were taken of a fettled casting and these were available for inspection by the audience.

Chills and Moulding

MR. TALBOT, answering the question about the chills, asked if Mr. Pierce thought there was a lot more work in fixing chills for aluminium than there was in moulding for iron. The over-all cost of making the mould, included the cost of placing the chills, from the time of commencing the job until the finish of casting, compared satisfactorily with what they would normally expect for making a similar casting in iron.

In the first place, the chills, of which three hundred and sixty-four were cast, with the exception of the block chills for the rim, were all machine-moulded and cast with about twenty in a box. All would realise how short a time it would take to make these. When gun-metal was used on them, it was all recoverable. The total time taken to make all the chills, including the machine-moulding, drilling, machining and everything else, was about 17 hrs., and their cost was spread over twenty-five wheels. The cost of the chills was a negligible feature. With regard to the setting of the chills in the mould, that operation was performed, he thought, in the only way feasible. He had examined the job from the iron-moulder's point of view and decided to simplify it, so he had sectional bottom plates made in four sections so that the moulders could get inside the pattern to set the chills. Two men could set all the chills on the outside and around the rim in two hrs. They built up the bearings, and he supposed it was obvious that these were a couple of nine-inch bricks built up from the bottom plate. Making the remainder of the bottom cod was just a matter of blanking it out. It might seem all wrong, perhaps, but actually worked out well. A few tools were made for close ramming, but the majority of the sand was thrown in. The bottom cod was rammed-up in less than four hrs. At a generous estimate, when they turned the job over and bedded it down and made the joint, it did not take longer than about twenty minutes, including setting the box down and fitting up the dowels. They rammed the outside part up in under one hour. With a comparative mould for a cast-iron pulley they would have had to take fairly elaborate precautions for staying the cods to prevent spread at the bottom and they would have had to ram pretty hard. He called moulding for aluminimum " toffee-apple " moulding. They did not have to take the same care over ramming as they did for iron and therefore considerable time was saved. The top was very ordinary moulding, and two men and a boy were able to ram that box up in less than three hrs.; they turned it over and the rest was plain sailing.

Setting the Cores

In fitting the cores, which they did one at a time, they sometimes found difficulty in getting the last core in. From that they learned their lesson and made wooden gauges and worked back from them. On the remainder of the wheels they were then able to set the cores, fit the side windows and close the cores and have all ready in two hrs. That he thought was pretty good going in fitting cores which weighed three and a half hundredweight. Considering this method in relation to core construction, it was one of the reasons why the print of the core had to be made of good material, and was so made that if it did come down pretty hard it would not damage the main bearing.

He thought that making the wheel in aluminium was a quicker process than making the same wheel in cast iron; the total time taken for the job, including five hours fettling time for two men, was exactly 44 hrs., which included 29 hours for moulding and core making. It was a continuous process and no time was wasted from the start of putting the pattern on until the top was put on and the metal was brought in.

MR. WILSON added that to finish off Mr. Talbot's clarification of the moulding it should be said that melting and moulding were going on simultaneously and they had the operations so gauged that they should end at the same time.

Porosity

MR. D. W. MORRIS asked why, in the beginning, they had started with gunmetal chills and, when the wheel was turned up, why was there no open metal or porosity showing in the curves of the spokes or in the boss?

MR. WILSON replied that the use of gunmetal chills was an idea which fell flat. Some of the chills were exhibited with the white deposit in them. He could not explain the phenomenon; they put in completely fresh chills straight from the grinder and, after use, when they came out of the mould, the grinding marks were undisturbed; but, nevertheless, there was a white deposit underneath the surface.

With regard to porosity in the Vee grooves at the junction of the spokes to the rim, or the spokes to the boss, as he had already tried to make clear, he felt it was one of those points on which they had done well. They had not had one wheel with any porosity at all at the junctions, and that was one of the reasons for the request of the customer for the X-ray photographs, which were now available for inspection.

Fluxing and Modification

MR. A. E. COHEN said there was one point about which he was not clear. He had understood Mr. Wilson to say that he melted the metal with sodium-fluoride/sodium-chloride flux. He believed that was a good modifier and quite a good degasser. He was wondering whether, if Mr. Wilson had used more flux, he could have done away with the necessity to modify again afterwards, outside the furnace.

MR. WILSON said he had never heard that flux called a de-gasser. It was only supposed to be a modifier. The larger the proportion of chloride the heavier the modification process. One thing against which he had been warned was volatilisation at low temperatures. One indication that the temperature was approaching melting was that they did find some volatilisation, as indicated by a blue haze which started to rise from the bath just over 650 deg. C. That gradually increased as the temperature rose, and it served as a guide to the temperature. They had never been troubled with complete volatilisation. When the temperature rose over 600 deg. C., the flux began to glow. It was most peculiar, for one realised the flux had not started to work until the glow commenced; whether it was caused by the sawdust burning he did not know. After the flux was skimmed off it became incandescent and seemed as though it was going to behave like Thermit.

MR. J. P. P. JONES wanted to know why Mr. Wilson went to the expense of modifying in the process of melting and then de-gassed afterwards. Wouldn't it have been more to the point to use an ordinary cheap covering flux for the melting process, then to de-gas and finally to modify with metallic sodium?

MR. WILSON explained that the flux they used was a proprietary brand. It was used as a covering flux, and only that. They used it so as to get some benefit from modification. Someone had predicted that they would get no modification after de-gasification. That, they had proved to their satisfaction, was inaccurate; modification was definitely carried through.

When machining one of the wheels which contained metal from the first wheel (which was scrapped), the metal was much tougher than any other. But the appearance of the skin after the machining was very striking; it cut rough like the edge of a file. With that metal they found very great difficulty in breaking off the risers, which to his mind proved modification. On the fracture, the grain size was very small. It was their opinion that modification was definitely carried through de-gasification.

Attracting Recruits to the Foundry

The CHAIRMAN at this point asked Mr. Talbot to address the meeting and give his views on how he dealt with young boys and made them keen to enter the foundry. It was a topic of great interest to all of them.

Responding to the request, MR. TALBOT said when he first took on the job with Western Foundries, he found he had walked into a shop of relatively young men. He, his colleague and his assistant were the old men of the shop. It seemed to him that if he could keep the foundry young all the time, it would not matter so much about the old boys—whom they did not have. Also, he looked at it from a young man's point of view and realised that, if he introduced trained moulders, they might have somewhat fixed ideas and whatever he did it would be wrong—he knew, because he had worked alongside "old boys." Under the circumstances it seemed that the best thing to be done was to get young fellows with slightly less experience than himself who would be likely to follow on the lines he wished; but when he came to increase his labour force, he realised he would have to start from the bottom and get in boys. With that idea in mind, an application was made to the Labour Exchange for boys. There were no replies. Then he approached the local schools and had a word with the headmasters and asked if he might likewise have a word with the boys, but was told it was not done. The headmaster's talking had no effect and there were no boys for the foundry.

Then he went round the shop to see if there were any parents whose boys would take up the job. In that way five boys were obtained and, as he himself had had to learn the hard way by having knowledge "knocked into" him, the parents' permission to use force if necessary was obtained, but he was glad to say they had not had to do that. They had threatened once or twice, but had not had to go to extremes.

In his private life he was in touch with a Scoutmaster, who one day said, "Your trade of moulder is a very interesting one. Why not come and have a talk to the Scouts?" He did this, and there were so many Scout organisations that he found that before very long he would have to be going out every night—the interest was so keen. To encourage his listeners he built a model moulding box and other foundry details. From these efforts he had not reaped all the benefit; someone else had got some of it, but he knew of four boys from one Scout troop alone who had taken up the trade.

Later, he received a call from some model makers to go along and give a talk; they lapped it up like a cat lapped milk. Of those model makers, two were so interested that they were taking on an extended scholarship course and, as technicians, were thinking of making the foundry their career. He had had several requests for literature on how to get into the foundry school. It seemed to be a very rocky road for foundry apprentices to get into the school. London was a long way away from it and unless there was a man which would sponsor them they could not get in. He would like to know if there were any facilities in London apart from the Polytechnic schools.

Recommendations

If any founders were present who wanted recruits, he suggested they should find out the organisations with which the youths were connected. He had been to speak to youth clubs and this was a peculiar experience, because quite 60 to 70 per cent. of the members of those clubs were girls. When he started talking about foundry work and trying to interest the boys it was necessary to consider the girls and tell them that if the boys went into the foundry trade what bright prospects they would have and what good money they could make. He told the youths that the majority of foundries to-day provided washing facilities and there was no reason for anyone to go away from work in a dirty condition. That was often a consideration of some importance, when youths were considering taking up a career, and if they could tell them they could go straight from work to meet their young ladies without going home to change it carried considerable weight.

Mr. Talbot also made an appeal for employers to interest themselves in the boys. They could not carry on with older men for ever. It was one thing to write to the JOURNAL about the *difficulty* of getting boys, but what were they doing to get boys in their own area? It was no good sitting at desks and doing nothing at all; he suggested that if some foundrymen were asked to speak to boys' clubs and they went and tried, they would find it quite easy, provided they got down to the boys' level and spoke understandingly about boys. They had to interest them and the only way to do that was by something practical. He exhorted his listeners to go and show the boys a bit of sand and show how it could be made into a mould shape and then produce the metal and tell two boys to do the moulding, and they would have all the youthful audience eating out of their hands in no time.

At Western Foundries, when they had a couple of lads they encouraged them to bring their friends in to have a look round, and by that means they had got one or two more lads. But the danger with that was that if the friend decided to go to the local saw mills they both went! To that problem he had not yet found an answer. At Western Foundries at least they had the chance of getting a very willing foundry staff. The jobbing foundries, in his opinion, were the best training ground. If they could get a young class of moulders in from the surrounding district and train them, there would be no shortage of good fully-skilled craftsmen. He hoped they would forget the word "moulders" and make boys brought into the industry understand that they were going to be craftsmen. He had plenty of moulders, but he had not many craftsmen, and that, he thought, was a general finding. If they were trying to persuade the boys to want to be craftsmen they would have to demonstrate the craft to them in many ways and when the boys came up with bits of questions which seemed petty they would have to step down and forget themselves for a while and listen to the boy.

He himself had learned in the hard school; when he had been handed over to his foreman his father had said "There you are; there is the material; make of him what you can!" "And," added Mr. Talbot, "believe me he did make something of me. I had no

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option!" He did not say that that was the right way, for he thought now that a little kindness would have had more effect than some of the rougher treatment that belonged to the past. Times had changed and they could not now take the same attitude as did the foundry managers who were their predecessors. In the old days, the boys were separated from the men, but now they came in with them. He did not say it was altogether good, but if the moulders were prepared to have their tea with the boys sitting down at the same tables he saw no objection to it. There was often more information passed to an apprentice over a cup of tea than could be given by a lot of talking. They had found the lads no trouble at meals in their shop and they tended, when they had any problems, to go to the men who were looked up to as craftsmen.

The onus of recruiting boys into the foundry was purely the foundrymen's individual responsibility—if they did as little as many employers were doing they would never have boys. He did not hold himself up as anything extraordinary—but he had got boys and many had not!

Vote of Thanks

Responding to the chairman's call to propose a vote of thanks to the lecturers, MR. G. C. PIERCE said he thought he would be voicing the thoughts and feelings of everyone present by saying they had had one of the nicest lectures for a long time. It was, also, the first practical Paper that they had had for some time and he thought the attendance justified some more practical Papers.

He had done some searching for boys. After he had used the well-known methods he had tried others. He had addressed boys' clubs and had taken a moulder along with patterns, core boxes and sand and had demonstrated. He had taken boys into the canteen and had later taken them round the foundry—specially working on a Saturday. There were about 40 boys concerned in that group and, as a result, thirteen boys promised definitely to start in the foundry on January 1. None did, however, for the simple reason that not far away a builder was putting up pre-fabricated huts and he was paying something like twice the amount of money that the employer in the foundry industry was able to pay. That was an angle somewhat outside that discussed in the Paper, but it was a point founders had to remember. It was definitely one of the major attractions to a boy these days—just how much money he got at the end of the week. In the old days, when he himself had started in a similar school to Mr. Talbot, the rate was 5s. 6d. per week; those days were finished. Locality was important, and how many industries there were in an area would partly decide whether boys entered a foundry or not.

There was only one other point in connection with the Paper that he would like to comment on and that was the charming description that Mr. Talbot gave to aluminium moulding—"toffee-apple" moulding. That was, he thought, an apt description and he fully agreed with him. There was no question about it, if they wanted a craftsman, working in iron, particularly a good-class green-sand iron moulder, and related his skill to that required from the aluminium moulder, they would find little basis for comparison at all. There should never be much difficulty in training aluminium moulders, but the other type of moulder was a different matter.

He sincerely proposed a vote of thanks to Mr. Wilson and Mr. Talbot for the charming and splendidly-delivered lecture that they had given.

In seconding the vote of thanks, MR. R. BLANDY said he thought Mr. Wilson and Mr. Talbot had done a marvellous job of work. He had had the privilege of talking to people who had been to the States and had seen four hundred tons of iron cast per day at foundries, but when he asked what was done in the jobbing foundries there and how did they work, the reply was, "Well, we have been in the States and it is an enormous country, but we could not find any jobbing foundries over there!" It did appear that in the States one could not get foundries that would take ones or twos, or even dozens, mostly they went in for mass production. There was one thing Mr. Talbot said that he would like to take up with him, and that was the question of dirt in the foundry. One did get dirt in a foundry, but when compared with the dirt a man got on his hands in a garage it was of no consequence. One could work all day in a foundry, go home and get clean. One could spend half an hour under a motor car and one would not get clean in a long time. Garages, however, seemed to have no difficulty in getting boys to work in them.

He had great pleasure in formally seconding the vote of thanks, which was carried with acclamation.

Authors' Reply

MR. WILSON, responding to the vote of thanks, said one of the things Mr. Talbot had not told them about was the novel apparatus he had used in lecturing. He had designed a pattern which resembled a locomotive wheel. Every boy knew and had seen a locomotive wheel and, as most boys wanted to be engine drivers, he had a very suitable subject to capture interest. He had a moulding box, nicely aluminium painted, black handles marked "top" and "bottom" so that there was no confusion. His talks were very simple and he had moreover made a model cupola in wood with which he demonstrated the charging melting and tapping. It was very topical and went down very well. The whole thing had been developed by Mr. Talbot and Mr. Clatworthy (his assistant).

MR. TALBOT replying, in turn, to the vote of thanks, said he had not gone there to preach about boys. He had gone there to support Mr. Wilson in presenting a Paper on the aluminium wheel, because the making of that wheel to him was an important matter and he was proud of it. He understood that no one had made a bigger wheel, and that he thought was a thing they would all appreciate. A production council had gone to America so as to be able to come back and recount what they could and could not do, but, so far, no one had gone round this country to see what we could do. Here, founders had very ordinary plant and were working on day-to-day jobs with no money to throw away on elaborate equipment and frills. The making of that aluminium wheel was to him one of the biggest things he had accomplished. If it had not been for the co-operation of the senior management and the spirit of understanding which existed between himself and Mr. Wilson, it would scarcely have been possible to carry the job through. He had told Mr. Wilson that if he would find the metal he would make the wheel, and the finding of the metal was the biggest problem. When the first casting was said to be a "scrapper," it had been a sad blow, but when they learned later on that it need not have been scrapped, that was even worse.

Mr. Wilson finally concluded his remarks by thanking his firm, LeGrand Sutcliffe & Gell, for the permission they had accorded for the use of data, photographs, and other matter relating to the production of the wheel casting.

Ceramic Glazes*

Points of Comparison with Vitreous Enamels

By S. H. Ryder

The intention of this Paper is to emphasise briefly certain of the main points in which the composition, preparation and properties of the glazes commonly applied to china, earthenware and tiles show marked contrast or alternatively close similarity to their parallels in the field of vitreous enamels as applied to steel and cast iron.

The points of comparison are chosen in a rather haphazard manner, but with the general object of stimulating discussion rather than presenting a scientific analysis of fundamental causes.

Chemical Composition

A superficial examination of the chemical composition of typical pottery and tile glazes in comparison with standard types of vitreous enamels reveals that the distinction is functional rather than fundamental, being a difference in degree more than in nature. This difference is the result of certain physical conditions which limit the properties of vitreous enamels. The principal factors to be considered in determining the properties and hence the compositions of vitreous enamels and which at the same time provide a key to the differentiation between enamels and glazes are as follows:—

(1) The "fit" between enamel and base iron or steel requires a coefficient of expansion of the order of 8 to 12×10^{-6} which is considerably greater than the corresponding range of glaze expansion coefficients, which can be approximately given as 3×10^{-6} to 7×10^{-6}.

(2) A vitreous enamel is not normally required to be clear or transparent and hence the presence of gaseous bubbles or crystalline, micro-crystalline or colloidal precipitates in the body of the enamel is not of itself undesirable. The majority of glazes, on the other hand, are of the transparent type and in the case of earthenware glazes frequently cover "underglaze" colour decoration, thus necessitating complete freedom both from entrapped and evolved air or gas and from opacity due to either undissolved or precipitated opaque particles.

(3) The firing or burning temperature for enamels varies between 700 and 900 deg. C., the majority of enamels being fired within the comparatively-short range of 750 to 850 deg. C. Ceramic glazes, even omitting the old-type low-fire raw lead glazes for tiles and artware and high-fire glazes for certain special electrical porcelain, are required to cover a higher and much wider firing range of, broadly speaking, 950 to 1,350 deg. C., thus calling for a greater variation in constitution and composition.

(4) The duration of the firing cycle in the vitreous-enamelling operation is of the order of 10 to 20 minutes, whereas a common pottery glost fire may extend over as many hours—and sometimes even more—as there are minutes in the enamel firing time.

It would be invidious and probably misleading to attempt to quote either particular or typical compositions to represent the principal groups of ceramic glazes and thence to make specific comparisons with various vitreous-enamel compositions, and it is therefore proposed to mention only the broader distinctions which can be summarised as follows:—

(*a*) Glazes maturing at the lower end of the previously-quoted glost firing temperature range still frequently contain lead oxide as a major and increasingly-expensive component, the principal reasons for its use being the good surface gloss obtainable with clear glazes, the fine crystalline effects in the rutile-containing tile glazes and the enhanced response to the addition of colouring agents. This contrasts with the elimination of lead oxide from practically all modern vitreous enamels, many of which possess good gloss and excellent durability or "acid resistance" although they are fired at temperatures which are approximately 300 deg. C. lower than most leadless glazes.

(*b*) The ratio of the strong bases (the alkalis) to the weaker bases (the alkali earths) is normally much lower in glaze compositions than in enamel compositions.

As a digression it is interesting to note that glaze compositions are almost always expressed as molecular formulæ in which the sum of the molecular contents of all the bases is adjusted to unity and compares with the molecular content of the neutral or amphoteric components such as alumina, Al_2O_3, followed by the acidic molecular contents typified by silica, SiO_2. This method of expressing ceramic compositions, although hardly ever used by the glass technologist and not always by the vitreous enameller, has much to commend itself both from the point of view of convenience and of logic. It illustrates without further calculation or cogitation the balance of basic and acidic components in any vitreous composition and portrays the molecular proportions of the component oxides in a manner that the percentage composition cannot emulate. Although modern theory of the structure of glasses, including, in general, glazes and enamels, postulates a continuous network populated in a random or relatively haphazard manner by atomic units, and consequently replaces the older theories specifying definite linkage between certain atoms forming more or less definite molecular associations in which whole numbers of the reacting molecules were involved, it is still true that the random network theory of structure is based on atoms and molecules and is not directly concerned with percentages. Molecular formulæ have still, therefore, a logical basis as well as being convenient for purposes of comparison, and are consequently likely to retain their favoured usage in ceramics.

Soda and potash are the cheapest, most convenient and powerful fluxes available to the ceramist in formulating a glaze or vitreous enamel. The considerations

* Paper presented jointly to the Institute of Vitreous Enamellers and the British Ceramic Society. The Author is on the staff of C. E. Ramsden & Company, Limited, Stoke-on-Trent.

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which limit the extent to which these common alkalis can be used are, generally speaking, the chemical durability (*i.e.*, resistance to attack by dilute acid and dilute alkali), the avoidance of devitrification (*i.e.*, crystallisation of silica), and the correlation of the coefficient of expansion to that of the basic body which the glaze or enamel has to fit. The vitreous enameller with his comparatively-high expansion "body," relatively-low silica content, short firing cycle and rapid cooling is not greatly restricted by the two latter factors and has been able to obtain adequate durability with combined soda and potash contents of 0.7 to 0.85 molecules. Glaze compositions, on the other hand, rarely exceed 0.5 molecules of soda plus potash, the limiting consideration usually being the coefficient of expansion to which soda and potash make a higher proportionate contribution than any other commonly used oxides, and hence have to be kept at sufficiently-low contents to ensure that the glaze expansion is not greatly in excess of the average body expansion. The glaze maker has thus to make considerable use of the less powerful fluxes such as the oxides of group II elements like magnesium, calcium, zinc and barium, particularly when he wishes to replace lead oxide in low-temperature glazes. Lithia and to some extent strontia have been advocated as powerful bases or fluxes for the formulation of low-temperature leadless glazes, but so far price has been a restrictive factor in this country.

(*c*) Compounds of fluorine are essential components of most vitreous enamels, but are hardly ever intentionally introduced into glaze compositions. Fluorine is a most interesting component of vitreous compositions for several reasons and fluorine compounds would probably well repay more extensive study as glaze constituents. Fluorine is the most electro-negative element present in glasses and enamels, being in some respects analogous to oxygen, the only other glass component which in its elementary state is a gas at ordinary temperatures. The frequent assignment of fluorine in vitreous-enamel molecular formulæ to a position along with the other acidic components is a debatable procedure, as the fluorine almost certainly replaces oxygen in the structure and is probably in preferential association with the basic metals such as sodium and calcium. It has been established that when fluorine is present in a vitreous enamel in sufficient concentration to produce opacity in the fired enamel, it usually separates as sodium fluoride, often in association with calcium fluoride even when the fluorine has been added as aluminium fluoride. Fluorine, however, apart from its function as a subsidiary opacifier by promoting the crystalline precipitation of fluorides fulfils a most important role in vitreous enamels. It contributes largely to the rapid maturing of an enamel by decreasing the viscosity of the fluid gases, thus accelerating the "fining" and flow processes necessary to the production of a high-gloss finish. The function of fluorine as a powerful flux is to be anticipated from the fact that the fluorides melt at lower temperatures than the corresponding oxides as shown in Table I.

The small percentage of fluorine present in Cornish stone, particularly in purple stone, is undoubtedly an important factor in the fusibility of this material.

It is perhaps worthy of note that the discovery in 1942 that uranium hexafluoride UF_6 is the only compound of this heaviest of all metals which exists as a gas, gave a tremendous impetus to the study of fluorine compounds.

In view of the present trend in pottery and tile manufacture to require glazes to mature in much shorter times than formerly, and to be leadless or have a very low lead content, it is of interest to note how these objectives are achieved by the vitreous enameller, bearing in mind the rather different conditions and limitations necessarily applicable to pottery and tiles and already detailed.

TABLE I.—*Relative Melting Points of Oxides and Fluorides.*

	Fluoride melting-point, deg. C.	Oxide melting-point, deg. C.
Sodium	990	1,275 (sublimes)
Potassium	856	—
Magnesium	1,270	2,800
Calcium	1,361	2,570
Barium	1,280	1,923
Zinc	872	1,975
Aluminium	1,040	2,050
Boron	−127	577
Silicon	−77	1,700
Lead	855	876

Compounding of Glazes

Having briefly dealt with certain points concerning the chemical composition or constitution of glazes it is interesting to examine the methods of compounding the different types of glazes in comparison with vitreous-enamel practice. All enamels are built up on similar lines in this respect, the mill mixtures consisting mainly of enamel frit with additions of clay as a suspending agent, opacifier if required and enamel oxide or colouring agent if the enamel is to be coloured. Glazes, however, are by no means uniform in their compounding, ranging from the high-fire porcelain glazes consisting of 100 per cent. mill material with no frit content at all down to certain low-temperature glazes containing practically 100 per cent. frit content. High frit content is required, as would be expected, for rapid-maturing glazes firing at a low temperature. Most lead-containing glazes are prepared from two frits, one containing all the lead oxide in a form which will comply with the Home Office test for soluble lead when it is incorporated in the ground state in the final glaze, and the other containing some of the other raw materials, including all those which would be soluble in the mill water.

The lead-free frits are known as borax frits, as they normally contain all the boric oxide. If the two frits are combined into a single frit, as is often done in America, this combined frit will not usually comply with the regulation regarding "low solubility" when ground in the glaze.

Common mill additions include materials such as china clay, Cornish stone, felspar, and calcined flint, the three latter materials being usually pre-ground before addition to the mill, this being necessary in order to avoid over-grinding of the frit which would occur if these hard raw materials were ground at the same time as the frit.

Glaze opacifiers are nearly always added at the mill and include such opacifiers as tin oxide, titania, zirconia and zircon. Opaque glazes are not in as much relative demand as opaque vitreous enamels, most ceramic bodies being white, ivory or other acceptable colours and therefore requiring only a transparent glaze. A decorative process frequently employed in pottery to mask the colour of a body produced for example from a red clay or a fireclay is to apply a white or suitably-coloured clap slip decoration direct on the clayware and subsequently to cover this slip or "engobe" with transparent glaze. The success of this process naturally depends upon the complete compatibility of body and engobe with regard to drying and firing contraction;

otherwise cracking or peeling will occur. Tin oxide is still, in spite of its high cost, preferred as the principal opacifier in bright or glossy-white opaque glazes, and is usually present in conjunction with other opacifying agents in the white semi-matt or " satin " glazes. Matt opaque glazes rely for their opacity on the development of micro-crystalline precipitates of such compounds as the silicates and alumino-silicates of calcium, magnesium and zinc, often in conjunction with titanium oxide, zirconium oxide or zirconium silicate. These matt glazes require strict control of firing conditions and particularly of the cooling schedule.

It is rather surprising that research into the production and control of opacity in glazes in this country and in America apparently lags behind parallel investigations undertaken in the field of vitreous enamels, where tremendous advances have been made in the last decade, resulting in the production of high-opacity white enamels opacified with titania and with zirconia. This type of enamel is so constituted that the opacifier has a fairly high solubility in the frit at the smelting temperature and a low solubility in the enamel at the firing temperature, so that crystallisation during the firing process shall be rapid and shall produce a finely-dispersed micro-crystalline precipitate of suitable grain-size range. This mechanism of opacification would undoubtedly repay close study with a view to its possible application and adaptation to pottery and tile practice, particularly now that the glost-firing operation as carried out in continuous tunnel kilns lends itself to much more precise control than the older intermittent kiln glost fire.

Colour additions used in the preparation of transparent and opaque coloured glazes are not usually milled with the glaze unless the quantity of any particular coloured glaze warrants the exclusive allocation of a separate mill for this one glaze. It is normally more convenient to grind the glaze stain separately and to lawn the required quantity of slop stain through the finest mesh available (250 mesh or 300 mesh) into the ground slop glaze, completing the dispersion of the stain in the glaze by thorough agitation followed by a further lawning of the stained glaze. Glaze stains are in the main similar to enamel oxides with the exception of certain metallic oxides and carbonates which can be used in the raw state to colour the majority of the low-temperature high-lead tile glazes.

Fritting

Glaze frits are at the present time produced in two types of furnace, the static reverbatory furnace and the rotary furnace.

The reverbatory frit furnace is almost invariably coal-fired. The normal design is quite orthodox, although modern furnaces make use of preheating of the combustion air and gravity feed from a coal hopper to improve the combustion efficiency. High-grade firebrick is usually chosen as the refractory for these furnaces, which normally hold between 10 cwt. and 1 ton of frit.

Rotary furnaces are used when closer control is required over the consistency and homogeneity of the frit. Rotary furnaces are usually lined with best firebrick, but where an adequate " burning-in " temperature is attainable, the advantages to be gained by the use of monolithic rammed linings are worthy of consideration.

With both the rotary and the static frit kilns, the use of mechanical mixers for the frit batch, while not universal, is desirable.

There is no doubt that the pottery industry has little if anything to teach the vitreous enamellers concerning the smelting of frits, as there has been constant improvement of technique in this phase of vitreous-enamel production during the past few years, culminating in the successful development of an automatic continuous fritting furnace complete with the corresponding mechanisation of the ancillary processes of batch-mixing, quenching, drying, and conveying to storage.

Grinding

The grinding of glaze in this country is now normally carried out in cylinders, the pan grinding of glaze having been replaced to a considerable extent.

Operational technique is quite orthodox and does not show any significant variation from the generalisations given by Creyke and Webb* for English cylinder grinding practice as applied to all pottery materials.

The sizes of cylinders used for glaze grinding cover a wide range, mills of up to 7 ft. dia. having been used. If certain precautions are exercised, it is possible to grind the same glaze both in the largest-diameter cylinders used and in a laboratory jar-mill, so that the two products are indistinguishable. In general, however, using the same proportionate charge, the larger units reduce the charge to the required fineness in a shorter time.

The Authors referred to above state that English " cylinder " grinding practice is typified by the following relationships: the gross or apparent pebble volume is normally about half the volume of the cylinder; the weight of the charge for materials with specific gravity of approximately 2.5 is usually a little less than half the weight of the pebbles and for the same class of materials the weight of water is roughly one-half that of the ground material. Calculating the void space between the pebbles as 40 per cent. of the gross or apparent pebble volume and assuming specific gravities of 2.64 for the pebbles and 2.5 for the charge, the above generalisations can be restated in terms of volume. Taking the basis of 100 for the total mill volume, the true pebble volume is 30 per cent., the charge volume 16 per cent., and the volume of the water 20 per cent., making a total occupied volume of 66 per cent. It is interesting to note the comparison with German practice for wet grinding pottery materials which Creyke and Webb quote as averaging a total occupied volume of 80 to 90 per cent. The optimum value of occupied space at which maximum output is obtained per unit of power is given by an American worker, Fahrenwald, as being about 75 per cent. of the cylinder volume.

The general, and probably most popular and convenient, size of cylinder used for the grinding of glaze has a diameter of 3 ft. 6 in., glazes of specific gravities from 2.5 to 4.25 and charge weights of 4 to 7.5 cwt. being ground to various stages between the coarse gradings required for the tile glazes and the very fine gradings called for in china glazes. The range of specific gravities of glaze charges is allowed for by calculating the charge weights to give a standard volume. The writer has found that a value for the charge volume of 17 to 19 per cent. of the total cylinder volume has given the best practical results for this size of mill when operated with a pebble charge of 40 per cent. by volume and a water content of 16 to 18 per cent. by volume. In order to compare these figures with vitreous-enamel practice, leadless glazes with a specific gravity of 2.5 are milled in a 3-ft. 6-in. dia. cylinder with an apparent pebble volume of 66 per cent., the weight of water being approximately 40 per cent. of the weight of charge.

Similar proportions are maintained in the case of the larger cylinders, except that the volume percentages for charge and water contents are reduced by between 2 and 3 per cent.

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* *Trans Brit. Ceram. Soc.*, 50, 55, 1941.

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Mill linings are normally constructed of Silex in the case of the larger-size cylinders and porcelain for the smaller-diameter cylinders, the respective grinding media being flint pebbles and porcelain balls. Successful operation has been reported using rubber linings for glaze grinding.

Physical Properties of Glaze Slips

Fineness.—Glazes in general require to be ground to a considerably greater degree of fineness than do normal vitreous enamels. The proportions of the very-coarse fractions retained by a screen can be used to illustrate this substantial difference. Ground enamel has a residue of some 10 to 15 per cent. retained on a 200-mesh standard sieve having an aperture of 76 microns (0.076 mm.), the residue retained on a 300-mesh sieve being 30 to 40 per cent. By comparison, the coarsest group of ground glazes are those for fireplace tiles and these normally have a residue on a 300-mesh sieve of approximately 5 to 10 per cent., the sieve aperture being 53 microns (0.053 mm.). Glazes for earthenware and bone china are ground considerably finer, most earthenware glazes having a residue on a 300-mesh lawn of less than one per cent., while many china glazes are ground to pass this sieve completely. The addition of electrolytes to maintain suspension is thus only necessary in the case of some glazes for tiles where a combination of coarse grinding and high-density material tends to make the glaze settle out at the concentration used for dipping. Small additions of electrolytes such as ammonium chloride and calcium chloride are sometimes made to earthenware glazes to modify the "thickness" of the glaze to suit particular dipping conditions.

The fluid properties of a glaze slip are, in principle, functions of the surface area and surface properties of the glaze particles in a unit weight of the glaze and hence the finer fractions of the ground glaze contribute proportionately more to the total fluid properties than do the coarse fractions. As, furthermore, the preponderant portion of the particles of ground glaze lies in the sub-sieve region, it follows that sieve residues cannot be used as an effective control or measure of the properties of a ground glaze and only to a limited extent as a check on grinding performance. Recourse has to be made to more precise methods of grain-size determination of which sedimentation tests as typified by the hydrometer method evolved by Webb and Ratcliffe, and elutriation as carried out in the apparatus designed by Andrews, are examples which are often used in routine checking. It is of interest to note that the established methods of elutriation and sedimentation are only intended for application to ground materials in which all the particles possess the same specific gravity, in which case the result is expressed as the percentages of the several fractions between calculated particle-size limits from which proportions an approximate equivalent "surface factor" can be derived. Both methods can, however, be applied to glazes containing both a leadless and a lead-containing frit, the particles of which are of different specific gravities, provided the determined fractions are only defined qualitatively as, for example, "coarse," "medium," and "fine," and the numerical results are only used for comparison of different grindings of the same particular glaze.

Viscosity.—If the viscosity of a glaze charge is determined either at the slop weight at which the glaze is being ground or, alternatively, at the pint weight at which the glaze is to be used for dipping, it is found, as would be expected, that viscosity increases progressively as the charge is ground. The viscosity of solid/liquid systems such as are encountered in the grinding of pottery materials is dependent upon the nature, the proportion, and the state of association or flocculation of the superfine particles of colloidal or near-colloidal size. As increase in the viscosity of a mill charge reduces the rate of grinding, it is of some importance to consider the proportion and state of flocculation of the superfine particles present initially or produced during the grinding operation. With a typical earthenware-glaze charge free from any initial colloidal material such as clay, the viscosity increase is gradual at the start, but increases rather suddenly at about the same time as the glaze is ground to normal fineness. The same type of glaze is used for china, for which purpose it is ground rather finer and consequently has a relatively-higher viscosity. In the case of glazes containing a substantial proportion of china clay, as is the case with many leadless fritted glazes, the increase in viscosity is quite rapid from the commencement of grinding and retards the rate of grinding considerably, the time required to reach standard fineness being increased by nearly 50 per cent. compared with the time of grinding for the same glaze free from china clay. If the clay is not added until the grinding is nearly complete, a much better grinding efficiency is obtained.

Relationship between Slip Properties and Glaze Take-up.—The vitreous-enamelling industry has, almost since its inception, used some simple form of dip test involving the weighing either wet or dry of the enamel taken up on a standard piece of freshly-pickled sheet of known area after dipping in the enamel and draining for a specified time.

The pottery industry has not, however, evolved any standardised or agreed test for checking the dipping qualities of a glaze during the two hundred-odd years it has been established in this country. The reasons for this are apparent. The enameller is dealing with a completely non-porous non-absorptive surface to which the enamel is usually applied by a readily-definable mechanical process, *e.g.*, by spray gun. He can consequently exactly determine these conditions in any one factory and reproduce them at any other works. It therefore only remains for him to prescribe the fluid properties of the enamel. The potter, on the other hand, has to contend with three distinct variables: the different porosity and hence absorptive properties, not merely of each different type of body, but also of almost each article and even of different portions of the surface of the same article; the variation in technique found with nearly every dipper involving such indefinables as the period of immersion, angles of contact and withdrawal, spinning and shaking action to spread the glaze and remove the excess and, finally, the fluid properties of the glaze which are often more comprehensively estimated by the feel of the experienced dipper than by the precise definition of such none-too-readily ascertained physical properties as the particle-size distribution, the viscosity, the thixotropy and the specific gravity.

One of the most comprehensive published investigations on this subject is a series of Papers given by C. G. Harman and co-workers.* These workers conducted an extensive series of trials using different types of glazes and applying them by a standardised mechanical dipper to various types of body with different porosities and densities. Their results indicate that a simple first-order equation can be derived for the correlation

* "Study of Factors Involved in Glaze Slip Control." *J. Amer. Ceram. Soc.* 27, 202—220.

between glaze consistency, body receptivity and thickness of deposition, this relationship being:—

$$P = K \left(\frac{R}{100}\right) (C - 0.001),$$

where P = glaze pick-up in gm. per sq. cm.

R = body receptivity in gm. of water × 10^4 per sq. cm.

C = coherence value of the glaze slip in gm. per sq. cm.

K = deposition constant for the particular glaze, calculated after the determination of a few accurate values of P, R, and C, and

0.001 = coherence values of water in gm. per sq. cm.

This equation ignores the variation in hand-dipping technique which is met in practice and cannot, of course, make any allowance for the differences in body porosity encountered even in the same batch of ware. It is intended however, to give an impression of the average results to be expected from any particular consignment of glaze as well as providing some comparison between different glaze batches by determination of their "coherence value" C.

This coherence value allegedly representing the working quality of the glaze slip is defined as the weight of slip adhering to a unit area of glass plate immersed in the slip and withdrawn from it vertically at a constant rate of one cm. per sec. It resembles, therefore, the dip test used in the vitreous-enamel industry. In addition to its use as a control test for slip consistency, the coherence value test is advocated as a check on incoming raw materials and as a basis for blending clays and other materials.

Used as a control test for glaze-slip consistency, these workers illustrated its efficacy by observing the fired results of 110 glost trials; of the 52 pieces of ware dipped in glazes with a coherence value greater than 0.04 gm. per sq. cm., 49 were faulty and only three were good, whereas, of the 58 trials made with glazes having coherence values less than 0.04, 49 were good and nine faulty, those nine having all been dipped in glazes with coherence values approaching 0.04.

A series of trials was carried out using a typical low-solubility glaze and a normal leadless glaze and determining their pick-up on glass, earthenware biscuit and china biscuit when hand-dipped under conditions which as far as possible were standardised. The two glazes were examined in this manner at various stages during the grinding operation, some of the samples being underground and some over-ground compared with standard glaze fineness. The leadless glaze was dipped at a pint weight of 29 oz. and the low-solubility lead glaze at 32 ozs. per pint, both glazes having the same solid to water ratio of 0.45:1 by volume. Although these trials have not been sufficiently comprehensive to establish any rigid relationship, the indications are that the "coherence value" of a glaze cannot be so easily applied as a correlated property to glaze pick-up on English pottery bodies, which are admittedly of different texture and type to American bodies. As a routine control for glaze-slip consistency, the determination of viscosity and thixotropy appears to offer more promise.

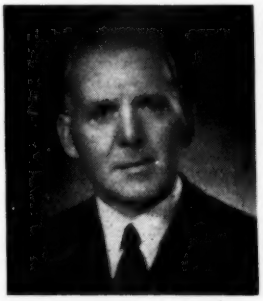
IMPORTS OF vitreous-enamelled hollow-ware into Portuguese West Africa in 1947 totalled 206.3 metric tons, of which Portugal (126.9) and Sweden (60.6) were the principal suppliers. This fact is disclosed in a recently-issued "Overseas Economic Survey" covering that country.

Leaders of the Industry

Dr. H. W. Webb

Dr. Harry William Webb, D.Sc., F.I.C., M.I.Chem.E., Principal of the North Staffordshire Technical College, Stoke-on-Trent, and President of the Institute of Vitreous Enamellers, has had a very distinguished career.

He was born in Boston, Mass., U.S.A., on September 29, 1893, and received his training in this country at the University of Birmingham, where he attained distinction as a Priestley Research Scholar, a Heslop Gold Medallist for Research and an 1851 Exhibitioner. He was also Captain of the 'Varsity Association Football and Cricket Teams, and President of the Guild of Undergraduates.



DR. H. W. WEBB, D.SC., F.I.C., M.I.CHEM.E.

In 1914, Dr. Webb had arranged to go to Hanover to work on Applied Chemistry, but on the outbreak of war enlisted in September in the 15th R. War. Regt., as a private, later being promoted Lieutenant.

From 1920 to 1928 he was head of the Industrial Chemistry and Fuel Technology Department, Cardiff Technical College, and from 1928 to 1930 Principal of the Aston Technical College, Birmingham, leaving there to take up duties at the pottery department, North Staffordshire Technical College, Stoke-on-Trent, where he has been ever since.

Dr. Webb has written various research Papers, notably those published in the transactions of The Ceramic Society, the Journal of the Society of Chemical Industry, and the Journal of the Chemical Society, being also Author of the book "Absorption of Nitrous Gases." He is a member of a number of societies, including the Ceramic Society, the Chemical Society, and the Society of Chemical Industry, and a member of the Rotary Club.

Sport has always held a great interest for Dr. Webb, he having played football against representative teams in Holland, Denmark and Czechoslovakia, and cricket for Cardiff, Glamorgan Club and Ground.

When Dr. Mellor, Principal of the College, resigned in 1934, Dr. Webb was chosen to succeed him and was at the same time made head of the pottery section of the college. In 1934, he became research director to the Export Earthenware Research Association and the Glazed Tiles Research Association. These associations were largely initiated by Dr. Webb and were housed at the Staffordshire College until 1937, when they were merged into the British Pottery Research Association.

From 1945 to 1946 Dr. Webb was vice-chairman of the Working Party on the Pottery Industry and in 1946 was awarded the O.B.E. for war services. He became president of the Institute of Vitreous Enamellers in 1948. As a worthy successor of the renowned Dr. Mellor, Dr. Webb has won for himself international recognition in the ceramic field, a field which through vitreous enamelling makes such a valuable contribution to the foundry industry.

Factors Affecting the Colour of Titanium Enamels*

By N. S. C. Millar

DISCUSSION

Opening the meeting for discussion, the chairman, Mr. C. P. Stone, said members had heard a good Paper well put over which provided much food for thought and study.

DR. H. W. WEBB added his congratulations, but queried whether the possible effects of minute traces of iron in the frit had been fully investigated. Instead of it being mere difference in crystalline form which made anatase opacification the better method, might it not be that traces of iron gave cream tints to the rutile? A second point was that he had found rutile opacification of certain types to be photo-sensitive to light. He reported that colour-stability of coloured titanium enamels, with, say, antimony, could be secured by a small addition of such an oxide as chromium. It was interesting to have Mr. Millar explain how much more stable is anatase with a colouring oxide than is rutile.

He was surprised to find that the Paper offered no explanations of the rôle of zinc oxide and alumina in the constitution of glazes. Finally, he asked at what temperature TiO_2 changed to lower oxides.

Effect of Additions

MR. MILLAR, replying, referred to a Paper given by Mr. Tickle which dealt with the effect of iron oxide. In the frit it acted as a lattice former, and in the mill it served to modify the crystal lattice. They, themselves, had not tried completely iron-free materials. If there were rutile seeds in the frit material, they might transform the anatase form to rutile, this mechanism would be favoured if the viscosity were low. The effect of zinc oxide and alumina (as these were refractories) was to lower the viscosity.

As regards the photo-sensitivity of rutile-opacified enamels, he agreed with Dr. Webb that there was some irridescence with this group not shown by the anatase variety. On the question of temperature of change, he considered a very low temperature of 700 to 800 deg. C in the presence of a reducing agent would be required.

MR. W. H. F. TICKLE said that complete absence of iron was a practical impossibility, but as far as their experiments went commercial "iron-free" materials gave yellowing with overfiring, and yet, with intentional additions of iron oxide, one per cent. was needed before the enamel was discoloured.

DR. BOWMAN considered it a proved fact that rutile had a cream tone as compared with anatase.

DR. B. K. NIKLEWSKI, pursuing the question of zinc additions, said that these acted as colour stabilisers because they favoured the anatase condition of a titanium enamel.

MR. H. LAITHWAITE asked for the limitations of the term "batch-free." The lecturer had said that the frit was taken beyond visual batch-freeness, but he contended that if this point were much exceeded the enamel deteriorated. From the practical point of view, he asked, was it feasible to adapt low-temperature, long-time firing? In his opinion, maximum reflectance was given by the use of higher temperatures.

MR. MILLAR replied severally to Mr. Laithwaite's queries. He repeated that complete "batch-free"-ness was important, but agreed that the point should not be over-run. X-ray examinaton could be used to determine the end-point of a trial batch, and subsequent batches could be standardised on a time/temperature basis. With regard to reflectance, he said the intention was to produce basically a bluish-white enamel. Normally, they had produced very bright enamels, but all on the creamy side. Now that the mechanism of anatase production was better understood, it would be possible to strike a balance to retain a fair degree of brightness.

DR. G. T. O. MARTIN was interested in what had been said concerning the viscosity of enamels; he thought there were narrow practical limits for this property. Also, discussing short firing times, insistence on these he considered would be of no use at all in the development of enamels for cast iron.

MR. MILLAR said the lower the firing temperature the better the viscosity, other things being equal, but it was necessary to have sufficient temperature to give good flow, glaze and other desirable properties, despite the fact that some of the anatase might be converted into the rutile form.

THE CHAIRMAN interposed at this juncture to adjourn the meeting owing to time limitations, and the proceedings terminated with an expression of appreciation being accorded to Mr. Millar for his excellent Paper and for so ably replying to the questions.

*A Paper presented at the Annual Conference of the Institute of Vitreous Enamellers, in Birmingham, October, 1949, and printed in the JOURNAL, December 1, 1949.

Publication Received

The Iron and Steel Trades in 1949—a Special Review. Published by William Jacks & Company, Limited, Winchester House, Old Broad Street, London, E.C.2.

This forthright statement makes interesting reading. It roundly condemns the Government's financial policy and rightly praises the effort made by the iron and steel industry. No mention is made of the foundry industry, which is perhaps as it should be, because the rôles of the two trades are different. It only confuses the mind of the layman to talk of them together. Foundrymen, however, would be well advised to study the paragraph on page 19 covering the subject of scrap. Imports this year have undoubtedly been heavy, something of the order of 2,200,000 tons as against 858,000 tons last year. With pig-iron at, say, £10 a ton and steel melting scrap at £3 12s., if this ratio persists it will have a profound effect on the economic production of steel, especially when the price of fuel is also taken into consideration. This review, which contains much wisdom, some dipping into history and a cartoon of much merit, is available to our readers on writing to Winchester House.

Obituary

MR. ALLAN ORR, who died at his home, 3, Allanvale Road, Prestwick, on Christmas Eve, was for many years costing clerk with Glenfield & Kennedy, Limited, engineers and founders, Kilmarnock.

MR. FREDERICK SHANKS, 13, Rosemount Road, Arbroath, died in Arbroath Infirmary on December 30 at the age of 49 after a few weeks' illness. He was the only son of the late James Shanks, of Alex. Shanks & Sons, Limited, Dens Iron Works, Arbroath. He graduated with a B.Sc. degree at Edinburgh University and, after army service, returned to the works, where he took over the managing directorship two years ago following his father's death.

Centenaries of 1950

By Geo. J. S. King

In the year 1850, the energy and enterprise of Britain's ironmasters were strikingly demonstrated in a memorable response to a national call and, as a result, the industrial powers of the nation were displayed to an astonished world in the Great Exhibition of the following year—the first occasion in history on which a nation comprehensively marshalled and exhibited its resources.

Exhibition Preparations

Throughout the closing months of 1850, feverish preparations were being made for the erection of the great structure of glass and iron which the world was to know as the "Crystal Palace." The leading glass manufacturers and ironmasters of the North and Midlands were called into urgent consultations and met at the offices of Fox & Henderson in Spring Gardens, for it was to these experts in iron construction that the contract had been entrusted.

The astonished mid-Victorians were notified that "the ironmaster had passed his word to cast in due time 3,300 iron columns, varying from 14½ ft. to 20 ft. in length; 34 miles of guttering tube, to join every individual column together under the ground; 2,224 girders (but some of these were of wrought iron), besides 1,128 bearers for supporting galleries." On September 14 the first castings for the iron columns were delivered, and this fantastic erection, which seemed to London in 1850 like the physical manifestation of an Aladdin's palace, began to rise in Hyde Park.

The story of the Great Exhibition belongs to the year 1851, although it was, of course, during 1850 that the work was done which the world saw in the following year. It was in 1850, for example, that Alfred Stevens, one of the greatest of British painters, was appointed chief artist to a Sheffield bronze and metal firm, and planned the designs which procured for that firm first place in the Exhibition; and it was in that year that Whitworth completed his famous measuring machine, and assembled the collection of patented tools and inventions which, at the Exhibition, won him the reputation of being the leading mechanical constructor of the age.

It must be remembered that 1850 belonged to the modern "Iron Age." The "Age of Steel" had not begun, for steel was still far too expensive for use, except for special purposes for which iron was not suitable. It is interesting to recall that the average wage of iron-founders, over all districts, was then 27s. 6d.—about £10 at to-day's equivalent. That Britain was becoming conscious of the fact that her constructive geniuses were of greater value to the nation than her destructive notabilities was shown in a striking passage in "Punch" in 1850. Robert Stephenson had completed in March the great Britannia tubular bridge over the Menai Straits, and "Punch," in commenting on the honour paid to military leaders for "killing a few thousand people," observed:—

> A thousand times greater man—a marvellous worker in iron, one Stephenson, drives the 2,000,000th rivet in the plate of the Britannia bridge, thereby consummating a work as great as the Pyramids. . . . Had Stephenson, from the cannon's mouth, fired away a hundredth part of the iron with which he has gripped Menai from shore to shore, his coat would have been hung with trinkets thick as a jeweller's window.

Notable Personalities

That famous metallurgical chemist, (Sir) Isaac Lowthian Bell, opened chemical works near Gateshead in 1850; and Andrew Carnegie became a messenger boy in Pittsburgh, thus beginning the career which made him America's foremast ironmaster. It was in that year that Joule, who had recently discovered the mechanical equivalent of heat, was elected a Fellow of the Royal Society; and it was a year of activity for Kelvin and Faraday; while John Fowler began the work that resulted in the construction of the steam plough.

There occurs on December 1 the centenary of the death of Aaron Manby, a Wolverhampton iron master, who took out a patent in 1813 for utilising the refuse slag from blast furnaces, and founded the Horseley ironworks at Tipton. It was at Horseley that he built "the first iron ship which ever went to sea." He founded, also, the famous Charenton foundry in France.

Robert Stevenson, who died on July 12, 1850, was a great Scottish engineer, noted chiefly as the builder of lighthouses, and George Stephenson admitted that he adopted malleable-iron rails on Stevenson's description.

The celebrities who were born a century ago are so numerous that only brief mention can be made of a few. Sidney Gilchrist Thomas was a famous metallurgist, who began a new phase in the European metal industry by his method of eliminating phosphorus in the Bessemer process of converting pig-iron into steel—a discovery which he announced at a meeting of the Iron and Steel Institute in 1878. Several of the celebrities born in 1850 were M.P.s, and among them were Horatio Myer, an ironfounder who represented North Lambeth, and Sir Thomas Palmer Whittaker (Spen Valley), who was for many years in the hardware and iron trade. Among other notabilities born a century ago were Gustav Lindenthal, who built steel bridges in America; Sir George Hingley, colliery proprietor and ironmaster; and Sir Thomas Acquin Martin, head of the Bengal Iron and Steel Company.

Domestic Stoves Production in Scotland

Scottish foundries manufacturing stoves, grates and fuel-saving appliances can look forward to at least ten years' steady work. This was stated by Sir Patrick Dollan, Scottish chairman of the Fuel Efficiency Committee, in Glasgow, on December 22. Sir Patrick said that during the next ten years 500,000 houses would be built in Scotland and 420,000 existing houses would have to be refitted with domestic fuel-saving appliances. Fifty per cent. of the appliances for the whole of Britain were being made in Scotland.

Ferrous Melting Furnaces in the U.S. and Canada

In printing the first section of the Paper, "Ferrous Melting Furnaces in the U.S. and Canada," in the December 22 issue of the JOURNAL, the illustration, Fig. 9, on page 739 was inverted. We present our apologies to the Author and all readers who have been puzzled or inconvenienced. The picture, correctly placed, would have shown the wishbone-type of cupola-charging bucket releasing its contents into the cupola shaft.

MR. J. W. HARGREAVES retired from the position of general manager of the Renfrew and Dumbarton works of Babcock & Wilcox, Limited, at the end of December. He is succeeded in this position by Mr. I. M. Lyon, previously assistant general manager. Mr. A. S. Peacock has been transferred from the London office to be assistant general manager of the Renfrew and Dumbarton works.

Imports Control

Relaxations come into Force To-day

At the end of September last, Mr. Harold Wilson, President of the Board of Trade, announced that, in accordance with the policy for liberalisation of trade which the Government had initiated at the Organisation for European Economic Co-operation, it had been decided to remove import licensing restrictions on imports into the United Kingdom of a wide range of goods from countries to which the relaxations could be applied without involving risk of loss of gold or dollars.

Mr. Wilson has now announced a further extension of the open general licence system. The new list of freed imports mainly affects raw materials, though some manufactured goods are affected. It will be valid as from to-day.

In announcing the new list, Mr. Wilson said that these relaxations, combined with those already in force, would fully discharge the Government's obligations under the O.E.E.C. decision of November 2 that quantitative restrictions should be removed on at least 50 per cent. of total imports on private account from other member countries.

In the raw materials group, U.K. relaxations will now extend to some 68 per cent. of imports in 1948 from the participating countries, and in the manufactured goods group to something over 50 per cent. For foodstuffs the figure is already over 50 per cent.

Warning to Traders

The Board of Trade, in a statement issued in conjunction with Mr. Wilson's announcement, warns traders not to place orders or open irrevocable credits, in anticipation of the issue of an open general licence until a further announcement appears in the "Board of Trade Journal."

"For an overall assessment of the extent to which restrictions remain on imports into the United Kingdom from other O.E.E.C. countries," the statement added, "it is necessary to take account not only of the area of trade covered by the relaxations of imports on private account, but also of the trade on Government account with O.E.E.C. countries covered by the open general licences. This is conducted in accordance with the principles of the draft Havana Charter, a basis equivalent to unrestricted private buying. Imports on private and Government account taken together represent £291 million or 71 per cent. of total imports from all O.E.E.C. countries as a group.

"The greater part of the remaining trade (£121 million) consists of trade with the countries to which, in present circumstances, open general licences cannot at present be extended without risk of loss of gold or dollars."

List of Goods

The following list, arranged under the various group headings, gives some of the additional goods freed from import licensing. The full list is printed in the current issue of the "Board of Trade Journal."

MINERAL PRODUCTS AND METALS—Abrasives, the following:—Aluminous oxide (fused); Corundum (natural); diamantine powders; emery; garnet concentrates and grain; microdol (micronised dolomite); pouncing flints, being crushed and graded quartz; pumice; shot and grit of iron or steel; silicon carbide; Tripoli powders; Vienna lime.

Aluminium and aluminium alloy ingots (secondary) containing more than 50 per cent. by weight of aluminium; asbestos manufactures, being goods made wholly or mainly of asbestos or asbestos cement; asphalt and bitumen (natural); brass, bronze (including aluminium bronze) and gunmetal in the form of ingots, containing 50 per cent. or more by weight of copper; building bricks and hollow blocks manufactured from clay; cement (calcareous); coal tar and coal-tar pitch; corhart bricks and blocks.

Ferro-alloys, the following:—Ferro-aluminium; ferro-beryllium; ferro-boron; ferro-carbon titanium; ferro-cerium; ferro-cobalt; ferro-copper; ferro-manganese; ferro-molybdenum; ferro-nickel; ferro-phosphorus; ferro-selenium; ferro-sulphide; ferro-titanium; ferro-tungsten; ferro-vanadium; ferro-zirconium alloys, containing more than 10 per cent. by weight of zirconium.

Manufactures wholly or mainly of non-ferrous metals and alloys thereof (excluding uranium, precious and rare earth metals and alloys containing any such metals), the following:—Wrought bars, rods, shapes, sections, and wire; wrought plates, sheets, and strip exceeding 0.006 in. in thickness; tubes, pipes and hollow bars of all sections.

Metals (other than alloys), unwrought, the following:—Antimony; calcium; cobalt compounds; manganese; molybdenum; tungsten; vanadium.

Molybdenum powder; mullite (calcined kyanite or cyanite).

Ores and concentrates, the following:—Beryllium; bog ore; cobalt; iron; manganese; tin; zinc.

Quartz, raw rock crystals and slabs, not processed; refractory or heat-insulating bricks and blocks; scrap metals, residues and wastes fit only for the recovery of metal (excluding sweepings, residues, refinable bars, lemel or other scrap containing precious metal); silica sand; tungsten powder.

CHEMICALS, DRUGS, MEDICINES, ETC.—Borax; boric acid; charcoal (other than activated or decolorising); iron oxide (natural); lamp black; zirconium oxide (natural).

MACHINERY AND PLANT—Machinery, including parts thereof, the following:—Bakery equipment (excluding travelling ovens); biscuit-making machinery (excluding travelling ovens); blast furnaces; boot- and shoe-making and repairing machinery; electro-plating, tinning, galvanising, and similar processing plant; gas and chemical plant; hosiery and knitting machinery (except fully-fashioned hosiery machines).

Lifting, hauling, and transporting machinery, the following:—Capstans; escalators; hoists; jacks; lifts; stackers; telphers; transporters; winches; winding skips.

Certain types of office machinery and packaging, etc., machinery.

Plantation machinery; rolling mills.

Machinery accessories, the following:—Belting of rubber-covered canvas; grinding wheels.

ELECTRICAL GOODS—Telegraph and telephone apparatus; watt-hour meters and parts thereof.

METAL MANUFACTURES—Balances and scales of a capacity exceeding 2½ cwt.; bolts, whether threaded or not, bolt ends, set screws and screw studs, and other screws for metal, and nuts, whether tapped or not (including washers assembled with any of these articles); screws for wood, including screw hooks, screw rings, and screw knobs, but excluding coach screws; cotter, grooved, and taper pins; expanded metal or meshwork formation, excluding such metal of iron or steel under 3 mm. in thickness; fish hooks; fittings for doors, gates, ventilators, and windows; window sashes of metal; flexible metal tubing and piping; knives, forks, and spoons, silver plated; radiators of a kind used for central heating.

C.F.A. Conference

The Council of Ironfoundry Associations has decided to hold another conference at which industrial management subjects can be discussed by representatives of member-firms. Details of the programme have not been settled, but the ironfounding industry is engaging in many new and progressive activities in the field of management at the present time, and all ironfounders who propose to attend can be sure that the conference will provide items of unusual interest. The conference will be held at the Spa Hotel, Buxton, from April 27 to 29, 1950. Further details will be announced later. In the meantime, member-firms are invited to reserve the dates.

IT HAS BEEN ANNOUNCED by the Steel Company of Wales, Limited, that MR. ANDREW HENDERSON is to be the manager of the Morfa shops which are now under construction on a site between the Margam works and the new Abbey works. The new shops will comprise a woodworking shop, paint shop and a central fitting shop which will include light and heavy machine and fitting bays, a smithy, boiler shop, and loco rolling stock repair bays. When completed, these shops will undertake all the repairs for the integrated works now being built at Margam.

Another Segregation Plan Rejected

South Durham Steel & Iron

The application of the South Durham Steel & Iron Company, Limited, to segregate the non-steel-making activities of the group, which include constructional engineering, has been rejected by the Minister of Supply. This was revealed by Mr. J. H. B. Forster, chairman, at the company's annual meeting on December 21. The announcement follows closely on a similar statement by Sir Ellis Hunter, chairman and managing director of Dorman, Long & Company, Limited, in respect of his company.

Mr. Forster told the South Durham Steel & Iron Company shareholders:—"Thus, in the event of control passing to the Government, the State will be engaged in competition with free enterprise in this country and in world markets, not only in the production of steel materials, but also in the sale of engineering products comprising, as far as your companies are concerned, pipelines for hydro-electric and supply purposes, steel tanks for storage purposes, steel-frame buildings, and many general engineering products. It is our hope that the nation will be wise enough to prevent this chaotic state of affairs from coming into existence."

Developments Expenditure

Referring to the capital expenditure which the directors have authorised to improve the all-round efficiency of both the West Hartlepool and Cargo Fleet works, Mr. Forster said that, irrespective of the ultimate destiny of the industry, it had been the policy of the directors to proceed with these schemes as soon as the requisite sanction from the Ministry of Supply had been obtained, as it is their view that national interests must take priority. Arrangements had been made, he said, to cover the estimated capital expenditure involved in these developments, and which might be in excess of the profits which would be retained. It was anticipated this expenditure would be spread over the next three to four years.

Though the company's achievements in increased production during the last 12 months had come up to the board's expectations, the object of these further developments was to enable increased outputs to be obtained at a lower cost of production.

The principal items involved consisted of:—West Hartlepool—(i) Improvements to the blast-furnace plant; (ii) two additional steel furnaces and improved scrap charging facilities; (iii) improvements to the slabbing mill to enable 15-ton ingots to be manipulated; (iv) additional heating capacity at the heavy and light plate mills. Cargo Fleet—A new blast furnace of 20-ft. hearth dia., which would enable pig-iron output to be increased by 50 per cent.

Since the end of the company's financial year the British Iron and Steel Federation had recommended to the Ministry of Supply that an additional steel furnace should be installed at Cargo Fleet. This would secure an increased output of ingots for the rolling mills which had been modernised in recent years. In view of the possibility of curtailment of supplies of imported scrap, which had been largely derived from Germany over recent years, it was the directors' intention to endeavour to get the new blast furnace in production within the shortest possible time, in order that there might be a minimum of disruption of supply of materials for the manufacture of steel products.

Pointing out that the profits of the South Durham Steel & Iron Company and its subsidiary companies amounted during the year to £1,361,785, Mr. Forster said that that figure represented a record level of profit in the history of the company and its subsidiaries. From the profits arising from the year under review, allocations were:—

	£	%
Interest on debenture stocks (net)	42,000	3
Sinking funds for 4 per cent. mortgage debenture stocks	25,000	2
Dividends (net)	42,000	3
Provision for taxation	454,000	33
Depreciation and reserves for future development and other purposes	761,000	56
Directors' and debenture trustees' fees, auditors' remuneration and staff pensions and life assurance schemes	38,000	3
	1,362,000	100

The statement showed that a sum amounting to 56 per cent. of the year's profits and exceeding £750,000 had been retained within the company. During the last two years, and ignoring a figure exceeding £500,000 provided for depreciation, a sum amounting to £850,000 had now been set aside from profits to finance the projects to which the chairman had previously referred.

Distribution of Profits

Mr. Forster added:—"You will further observe that dividends paid on all classes of preference and ordinary shares are equivalent to only 3 per cent. of our total profits. No justification can exist for statements which have been made from time to time to the effect that shareholders are receiving an undue proportion of the earned profits and that insufficient provision is being set aside for future developments." Both in achievements of increased outputs and ability to maintain costs of production at an economic level, the iron and steel industries had clearly proved their case to continue as industries devoid from State management which was already causing grave concern in the increased level of costs in those sections of national production and services where State ownership was being applied.

It was a difficult problem, he said, to forecast the future level of production for the industry. As far as steel plate production was concerned, the tonnage on the company's books and orders coming in showed at present no appreciable reduction. The fact, however, must not be overlooked that shipbuilders were finding it increasingly difficult to book orders.

Latest Foundry Statistics

The most recent figures show the production of iron castings in Period III of 1949 amounted to 793,039 tons, bringing the total for the first three quarters of the year to 2,520,021 tons, equivalent to an annual rate of 3,360,028 tons.

Output in the various sections of the industry was as follows:—

	Period III.	Periods 1 to III.
	Tons.	Tons.
Automobile	50,699	157,404
Building and domestic	110,288	349,392
Cast-iron pipes	128,112	404,965
Engineering and jobbing	351,622	1,073,912
Ingot moulds	77,723	247,219
Railway equipment	74,595	238,403

It is an encouraging fact that the output in the third quarter of the year was nearly 15,000 tons greater than the corresponding figure in 1948. If the industry has maintained its recent rate of production up to the end of the year, it can be expected that the total tonnage for 1949 will prove to be larger, though probably not substantially so, than the record output which was achieved in 1948.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ACICULAR CAST IRON

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—The publication of the Paper by Mr. W. W. Braidwood on acicular cast iron in your issues of December 1, 8, and 15, contains statements regarding the early history of the development of acicular cast iron which call for comment

Mr. Braidwood states during his introduction that "the structures of these exceptional irons were recognised as distinctive, but an understanding of why they occurred and how their production could be controlled was not developed until the systematic study of the subject by Flinn and Reese in 1941."

During the reported discussion of the Paper the matter was again referred to as follows:—"Many people laid claims to having made acicular iron in the past. Probably they did, but did they know how or why they were producing acicular structures? The controlled production of acicular cast iron dated from the time of the systematic study of the subject by Flinn and Reese in 1941."

In 1937, nickel-molybdenum acicular cast irons were entirely independently developed in the works with which the writer is associated and during the autumn of that year manufacture was placed on a commercial production basis for certain parts of the firm's products.

Early in 1938, acicular cast-iron crankshafts were made which were not "found, somewhat inexplicably, to exhibit exceptional strength and toughness, allied with high machinable hardness," neither was their production in any way "uncontrolled"; they were the result of metallurgical and production "know how" and technique. In fact, mechanical properties determined on bars cut from these early shafts have not as yet, to the writer's knowledge, been excelled by an acicular cast iron of normal flake-graphite type in the "as-cast" condition.

Effects of variation in composition, covering all the usual elements, had been determined as well as the use of various types of charge materials. Heat-treatments had been explored and the ranges and limits of various combinations to give the best results in different sections had been worked out. Application has steadily developed from that time.

A great deal of work has been done by many people on acicular structures and the production of acicular cast iron. Mr. Braidwood's Paper is an excellent *résumé* of the subject and the value of the work of Flinn and Reese is fully acknowledged; nevertheless the development of acicular cast iron in this country was neither a consequence of that work nor dependent upon it.

Yours etc.,
C. R. VAN DER BEN.

241, Rose Hill,
Ashton-under-Lyne, Lancs.
December 29, 1949.

New Catalogue

Moulding Machines.—A three-page folder illustrating ten different designs of moulding machines has been sent to us by the British Moulding Machine Company, Limited, of Faversham, Kent. Externally the folder carries an impressive picture of a foundry floor covered with orderly rows of one type of mould, and on another page there is an interesting selection of complicated machine-moulded castings. It will interest our overseas readers to know that, apart from the English version, others are available in French, German, Italian and Spanish, and are to be obtained on writing to the works at Faversham.

House Organs

Sif-Tips. Vol. 13, No. 68. Published by the Suffolk Iron Foundry (1920), Limited, Stowmarket.

Contained in this issue is an interesting example of "taking one's own medicine," for there is a fully illustrated description of the repair by welding of a 15-cwt. moulding-machine body which showed a 18-in. long crack mid-way up the pillar. This machine was in use at the works of the publishers, and since the repair has given good service. A second job described is the repair of a cast-iron domed evaporator casting weighing just over 2 tons. The balance of the issue is made up of the usual features.

The Stantonian. Vol. 17, No. 2. Published by the Stanton Ironworks Company, Limited, near Nottingham.

This issue records a number of ceremonies in connection with the departure of Mr. R. D. Lawrie, the foundry's superintendant, to assume a post in Scotland. There is also a photograph of the casting of the millionth screwed gland, the production of which was started in October, 1947, and the cast illustrated was made on July 22, 1948.

S. & W. Magazine. Vol. 4, No. 1. Published by Smith & Wellstood, Limited, Bonnybridge, Scotland.

This issue follows the usual make-up with a record of Bonnybridge happenings and notes from the London and other offices, plus a few letters from overseas.

Broomwade News Bulletin, Vol. 12, No. 6. Published bimonthly by Broom & Wade, Limited, High Wycombe.

Announced in this issue is the quantity production of a new high-speed, light-weight air compressor. It weighs but 50 lb. and can be plugged into any convenient power point. There are two pictures of portable compressors in Australia; both have interesting backgrounds, but are somewhat spoiled by untidy foregrounds. The new sand rammer, recently placed on the market, is also illustrated.

The M. & C. Apprentices' Magazine. Vol. 33, No. 132. Published quarterly by Mavor & Coulson, Limited, Glasgow, S.E.

The M. & C. apprentices should indeed be proud of their magazine as it obviously succeeds in its appeal to youth. For the general public, the major interest is the intelligent manner in which the suggestion scheme has been handled. The type of publicity given to efforts made is bound to encourage others to make suggestions for the better operation of the factory.

One Hundred and Eleven. Vol. 10, No. 4. Published by the Hammond Lane Foundry Company, Limited, 111, Pearse Street, Dublin.

This quarterly magazine is primarily written for the staff, in fact the purport of many of the paragraphs is quite obscure to the outside reader. There are some general-interest stories and, always in a light vein, accounts of the activities of the sporting and social clubs. The magazine is essentially Irish, and as the reviewer is also something of a "mickey," its humour is especially savoured.

Ruston News, Vol. 4, No. 1. Published by and for the employees of Ruston & Hornsby, Limited, and its associated companies.

This issue, full of photographs, records all the social activities of the staff of this large firm of engineers and founders. At the Spike Island foundry, the main recreations seem to be bowls, fishing and darts. Mr. Shepherd has presented a cup for the winners of an annual bowls competition.

New Year Honours

Details of Some Awards

The New Year Honours List contained the names of a number of prominent men connected with the foundry and iron and steel industries. Below are details of some of the awards, and further particulars will be included with our next issue.

Barons

SIR A. STEPHEN BILSLAND, BT., director of Colvilles, Limited, Chairman of the Scottish Council (Development and Industry) and, recently, a member of the Dollar Exports Board.

MR. JOHN WILMOT, M.P. for Deptford, Minister of Supply 1945 to 1947, deputy chairman of Boulton & Paul, Limited.

Knights

COL. ROBERT CHAPMAN, chairman of the North-East Trading Estate and North-Eastern Investment Trust and deputy chairman of George Angus & Company, Limited.

Order of the Bath

C.B.

COL. DOUGLAS STEPHENSON BRANSON, director of Park Gate Iron & Steel Company Limited.

C.M.G.

MR. PHILIP ERIC MILLBOURN, chairman of Spencer (Melksham) Limited and adviser on Shipping in Port, Ministry of Transport.

Order of the British Empire

C.B.E.

MR. J. R. BEARD, past-president of the Institution of Electrical Engineers, partner, Merz & McLellan, chairman of various committees of the British Standards Institution; MR. A. R. KNOWLES, secretary-general, Association of British Chambers of Commerce; MR. J. McF. MCNEILL, managing director, John Brown & Company, Limited, director John Brown & Thomas Firth (Overseas), Limited, vice-president, Institute of Naval Architects; MR. J. MORRISON, director and shipyard manager, Harland & Wolff, Limited; MR. P. G. NORMAN, director, Builders' Material Association; MR. W. H. STOKES, chairman, Midland Regional Board for Industry; LT.-COL. C. W. THOMAS, chairman, E. J. & J. Pearson, Limited.

O.B.E.

MR. H. HEPWORTH, delegate managing director, Imperial Chemical Industries, Limited (Pharmaceutical Division); MR. C. MCFETRICH, chairman, N.E. Metal Fabrications, Limited, director, Bartram & Sons, Limited; MR. J. G. PEARCE, director, British Cast Iron Research Association; MR. J. R. PEARSON, director and factory manager, Vauxhall Motors, Limited; MR. F. F. J. B. ROBERTS, director, British Basic Slag, Limited.

M.B.E.

MR. A. HASELDEN, general works manager, Ford Motor Company, Limited; MR. A. R. C. HUNTINGTON, chairman and managing director, William Champness & Sons, Limited; MR. W. R. SCOTT, chairman, Western District Committee, Scottish Board for Industry.

Personal

SIR JOHN DUNCANSON has joined the board of British Polar Engines, Limited, Glasgow.

MR. R. J. HOGBEN, brake sales engineer of the Westinghouse Brake & Signal Company, Limited, has been appointed assistant sales manager of the company.

MR. JOHN W. BUTLER, who has been assistant secretary to the Council of Ironfoundry Associations, has been appointed to the position of Acting Secretary.

AIR VICE-MARSHAL GERARD COMBE, a former director-general of armament at the Air Ministry, is to succeed, in February, VICE-ADMIRAL SIR HAROLD KINAHAN as president of the Ordnance Board, Ministry of Supply.

MR. D. SOMERS BROWN, engineering manager, has not sought re-election to the board of Parsons Marine Steam Turbine Company, Limited, Wallsend, owing to ill-health. He has been associated with the company for 48 years.

MR. T. S. READ, managing director of the Shields Engineering & Dry Dock Company, Limited, North Shields, has been presented with an inscribed gold watch in recognition of having completed 50 years' service with the firm.

MR. G. C. M. JACKSON will cease to hold the position of managing director of the Sheepbridge Company, Limited, as from January 1. He has also resigned his seat on the board. MR. A. V. NICOLLE has been appointed managing director of the company.

MR. ALFRED BAER, who was recently elected a director, has been appointed a vice-chairman of the Consolidated Zinc Corporation, Limited. He has resigned from his appointment as joint managing director of Henry Gardner & Company, Limited, metal merchants, etc., and as a director of the Amalgamated Metal Corporation, Limited.

MR. C. W. J. GELLATLEY has resigned from his position as metallurgist with the Automatic Telephone & Electric Company, Limited, Liverpool, on his appointment as assistant chief of the development department of Baker Platinum, Limited, Kennington, London, S.E.11. He is succeeded as hon. secretary of the Liverpool Metallurgical Society by MR. J. A. PARDOE, 183, Queens Drive, Walton, Liverpool.

MR. WALTER V. MIZEN has resigned from the position of managing director of Mosers, Limited, iron and steel, etc., stockholders, of London, S.E.1, and Nettlefold & Sons, Limited, due to health reasons. Although retiring from active work, he will remain a director of both companies and also of W. Galloway & Company, Limited, nail manufacturers, etc., of Gateshead. MR. H. B. HOUNSELL and MR. F. CROOKALL have been appointed joint managing directors of Mosers, Limited, and Nettlefold & Sons.

MRS. AMY ROBINSON, a grandmother—one of the oldest of Black Country coremakers—has been a foundrywoman for 41 years and at 54 is still employed full time at the Great Bridge Foundry, West Bromwich. She makes anything from simple saucepan plugs and kettle spouts to the biggest of engine-cylinder cores. Her working life began in a foundry and in her time has covered many aspects of foundry work; she has no intention of leaving her job until she is forced to do so.

Imports and Exports of Iron and Steel

Board of Trade Returns for November

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in November. Figures for the same month in 1947 and 1948 are given for purposes of comparison.

Total Imports of Iron and Steel

From	Month ended November 30.		
	1947.	1948.	1949.
	Tons.	Tons.	Tons.
Australia	2,705	1	2
Canada	4,970	6,099	4,416
Other British countries and Irish Republic	255	774	235
Sweden	1,322	1,805	970
Norway	597	4,165	1,003
Germany	—	188	2,727
Netherlands	47	4,897	4,491
Belgium	8,857	34,683	13,032
Luxemburg	1,778	8,167	8,653
France	75	3,815	4,448
U.S.A.	19,348	6,301	2,819
Other foreign countries	19	443	697
TOTAL	39,973	71,338	43,493
Iron ore and concentrates—			
Manganiferous	—	3,500	—
Other sorts	452,241	748,995	598,027
Iron and steel scrap and waste, fit only for the recovery of metal	48,539	100,203	172,822

Exports of Iron and Steel by Product

Product.	Month ended November 30.		
	1947.	1948.	1949.
	Tons.	Tons.	Tons.
Pig-iron	430	271	1,345
Ferro-alloys, etc.—			
Ferro-tungsten	35	150	80
Spiegeleisen, ferro-manganese	748	181	2,128
All other descriptions	75	71	67
Ingots, blooms, billets, and slabs	414	783	314
Iron bars and rods	496	564	575
Sheet and tinplate bars, wire rods	111	327	176
Bright steel bars	1,784	2,306	2,226
Other steel bars and rods	9,746	9,524	16,306
Special steel	1,736	1,351	1,536
Angles, shapes, and sections	4,767	9,662	8,718
Castings and forgings	487	766	990
Girders, beams, joists, and pillars	787	1,482	2,992
Hoop and strip	2,975	5,485	5,649
Iron plate	2	1,129	1,759
Steel plate, ¼ in. thick and over	8,774	10,561	19,043
Do., under ¼ in. thick	5,202	10,052	11,042
Galvanised sheets	5,145	7,886	7,672
Tinplates	8,368	20,147	15,778
Tinned sheets	597	1,354	213
Terneplates	16	42	96
Decorated tinplates	272	405	25
Other coated plates	224	59	767
Cast-iron pipes, up to 6-in. dia.	4,461	6,588	5,382
Do., over 6-in. dia.	2,443	6,704	4,296
Wrought-iron tubes	23,938	25,743	26,930
Radiators, central-heating boilers	388	292	381
Railway material	11,442	12,797	13,838
Wire	2,295	3,649	5,644
Cable and rope	2,067	2,112	2,411
Netting, fencing, and mesh	1,948	1,672	1,305
Other wire manufactures	462	1,437	1,246
Nails, tacks, studs, etc.	718	1,163	450
Rivets and washers	668	1,235	665
Wood screws	596	385	336
Bolts, nuts, and metal screws	1,544	2,055	2,334
Stoves, grates, etc. (excl. gas)	708	947	867
Do., gas	208	281	268
Sanitary cisterns	109	181	177
Baths, sinks, etc.	371	870	1,257
Fencing material	422	163	598
Anchors, etc.	610	676	911
Chains, etc.	805	692	1,022
Springs	407	939	522
Hollow-ware	4,181	4,981	8,960
All other manufactures*	17,719	19,352	20,173
TOTAL	131,701	179,472	198,606

* Figures for 1949 are not completely comparable with those for previous years.

Total Exports of Iron and Steel

Destination.	Month ended November 30.		
	1947.	1948.	1949.
	Tons.	Tons.	Tons.
Channel Islands	575	1,264	732
Gibraltar	213	61	151
Malta and Gozo	232	647	450
Cyprus	155	630	322
British West Africa	3,687	5,187	8,399
Union of South Africa	8,490	12,379	9,374
Northern Rhodesia	261	1,080	1,782
Southern Rhodesia	2,083	2,016	2,789
British East Africa	6,262	7,297	9,743
Mauritius	142	905	969
Bahrein, Koweit, Qatar and Trucial Oman	814	1,798	387
India	5,223*	6,679	5,074
Pakistan		2,553	4,168
Malaya	3,549	2,995	5,761
Ceylon	766	1,398	2,316
North Borneo	1,161	765	306
Hongkong	1,424	2,194	3,810
Australia	3,481	8,324	22,749
New Zealand	3,385	9,010	12,133
Canada	1,123	6,825	4,816
Bermuda	36	49	76
British West Indies	4,979	3,917	3,543
British Guiana	209	373	498
Anglo-Egyptian Sudan	458	1,205	1,415
Other British countries	178	984	765
Irish Republic	4,895	5,536	6,796
Russia	—	2,176	146
Finland	8,108	5,184	5,578
Sweden	6,038	4,252	5,337
Norway	2,454	8,078	5,228
Iceland	151	479	655
Denmark	9,139	9,212	6,968
Poland	35	222	27
Germany	4	23	9
Netherlands	6,339	8,816	7,053
Belgium	1,455	968	991
France	517	1,538	1,385
Switzerland	1,298	1,241	663
Portugal	625	1,669	2,265
Spain	251	308	384
Italy	144	815	388
Hungary	9	19	69
Czechoslovakia	77	261	9
Greece	332	494	273
Turkey	630	2,023	963
Dutch East Indies	945	993	952
Dutch W. India Islands	977	280	713
Belgian Congo	328	194	29
French W. and Eq. Africa	111	37	30
Portuguese East Africa	200	351	387
Canary Islands	316	599	270
Syria	10	37	28
Lebanon	349	2,500	1,409
Palestine (Israel)	3,204	324	975
Egypt	2,515	4,155	3,717
Morocco	44	34	455
Iraq	4,578	2,705	956
Iran	3,962	11,232	16,176
Burma	4,193	1,093	782
Siam (Thailand)	28	280	1,558
China	3,390	1,009	42
U.S.A.	125	195	1,279
Cuba	87	29	68
Colombia	528	644	1,105
Venezuela	6,456	4,969	2,985
Ecuador	452	974	94
Peru	551	61	673
Chile	1,873	526	501
Brazil	1,134	2,099	1,879
Uruguay	378	392	379
Argentine	2,484	7,565	10,487
Other foreign countries	1,098	2,346	2,962*
TOTAL	131,701	179,472	198,606

* Figures for 1947 relate to British India.

STANTON-DALE

REFINED PIG IRON

Designed to meet the demands of high quality castings, which are, strength, machineability and resistance to wear.

All these can be secured by using Stanton-Dale Refined Pig Iron in your cupolas.

The above illustration shows a group of castings made by Messrs. Goodbrand & Co. Ltd., Stalybridge, Cheshire.

PROMPT DELIVERY

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

Raw Material Markets

Iron and Steel

Production of pig-iron has now overtaken current requirements. Stocks are substantially higher than they were 12 months ago and the position is so much easier that, on a limited scale, the export of pig-iron has been resumed. The outlook for the foundry trades in 1950 is somewhat obscure, but most of the works are still busily engaged and are taking up their full allocations of pig-iron. Accumulations of foreign ores at the ironworks are substantial and ample supplies of coke and limestone are available to maintain the current scale of operations at the blast furnaces.

Imports of foreign semis have been substantially reduced. This is a not unwelcome development which will afford an opportunity for re-rollers to absorb the considerable tonnages already in hand. Re-rollers of steel bars are now encountering keen Belgian competition at cut prices and this may be a decisive factor in determining the volume of exports during the ensuing quarter.

The heavy rolling mills still have impressive programmes for the next three months. Heavy sections are in fairly wide demand, while the home call for steel plates is supplemented by numerous export orders and inquiries. It looks as though plate-mill capacity will be taxed to its utmost limit for the next quarter or even longer, while sheetmakers are confronted with a similar situation, the demand for sheets, particularly the lighter gauges, being far in excess of the supply. A further advance in the price of galvanised corrugated sheets has been authorised, 24 gauge being now quoted at £38 6s. 6d. per ton.

Non-ferrous Metals

On both sides of the Atlantic, stock markets and the commodities made a good finish last year and the indications are that, initially at any rate, 1950 will take up the running. Many metal traders expected a rise in copper before December 31, for buying by U.S. consumers continues at an undiminished rate, and it is probably true to say that almost at any time during the past few weeks the American producers could have added ½ cent to the current quotation without checking demand. But the policy of restraint is likely to prove wise in the long run, since the force of the American demand will doubtless diminish in due course.

Actually, the only increase between Christmas and the year-end was in zinc, which advanced to 10 cents in America, a rise of ½ cent per lb., and in Britain by £2 to £87 10s. per ton. During the past two months there have been a good many ups and downs in the price of this metal and it would not be wise to assume that the new level is in any way permanent. These fluctuations on the American market are caused mainly by changes initiated by the custom smelters, and the quotation is perhaps just as likely to decline as rise.

Amid the general firm trend at the year-end the tin market was exceptional, and last week the cash quotation declined by about £6. The three-months quotation, however, only fell by about £4, so the process of narrowing the backwardation continues. In the early days of trading on the reopened tin market, the premium for cash metal stood at one time as high as £80, but this has now diminished to approximately £20.

The close of the year saw a very firm tone in brass and copper scrap, prices of which have been building up over the past few weeks. Demand is good and it would appear that, in copper at any rate, the supply is insufficient to meet the present needs of the market. The scarcity is most noticeable in the highest grades of copper, such as H.C. wire, commutor material, etc. Refinery copper scrap is more plentiful, but demand at present is less insistent than for high-class types which can be used in the manufacture of alloys. With electrolytic copper at £153 per ton, it is fairly evident that users will give full consideration to the employment of substitutes whenever possible. Brass is more plentiful, if only because of the steady flow of 70/30 metal in the form of Q.F. and S.A.A. cases which the Ministry of Supply is selling by tender.

The London Metal Exchange was closed on Monday; other days' tin quotations were as follow:—

Cash—Thursday, £600 to £601; Friday, £600 to £600 10s.; Tuesday, £600 10s. to £601; Wednesday, £600 10s. to £601.

Three Months—Thursday, £575 to £576; Friday, £577 10s. to £578; Tuesday, £578 5s. to £578 10s.; Wednesday, £580 10s. to £581.

Increases of Capital

Details of increased capital have been announced by the following companies:—

BRIDGE FOUNDRY COMPANY, LIMITED, Wednesbury, increased by £35,000, in £1 ordinary shares, beyond the registered capital of £25,000.

HARD ALLOYS, LIMITED, High Wycombe, increased by £5,000, in £1 5 per cent. cumulative preference shares, beyond the registered capital of £15,000.

JOHN INGHAM & SONS, LIMITED, iron and steel merchants, etc., of Ossett (Yorks), increased by £50,000, in £1 shares, beyond the registered capital of £10,000.

SMITH BROS. & COMPANY (HYSON), LIMITED, brassfounders, etc., of Nottingham, increased by £25,000, in £1 shares, beyond the registered capital of £25,000.

BAKER & WALSH, LIMITED, weighing machinery manufacturers, etc., of Hounslow (Middx), increased by £3,000, in £1 ordinary shares, beyond the registered capital of £3,500.

BUSSEY & SABBERTON BROS., LIMITED, electrical and general engineers, founders, etc., of Norwich, increased by £5,000, in £1 shares, beyond the registered capital of £20,000.

C. & A. STEWART, LIMITED, brassfounders, of Glasgow, increased by £34,000, in 14,000 ordinary, 4,000 unclassified, and 16,000 preference shares of £1, beyond the registered capital of £6,000.

HIGH GRADE STEELS, LIMITED (formerly British & Saar Steel Company, Limited), London, S.W.1, increased by £1,000, in £1 non-voting shares, beyond the registered capital of £10,005.

BEECH, HILL & COMPANY, LIMITED, foundrymen, of West Bromwich, increased by £14,000, in 4,000 ordinary shares and 10,000 5 per cent. cumulative preference shares of £1 beyond the registered capital of £6,000.

Company Results

(Figures for previous years in brackets.)

TURNER & NEWALL—Final dividend of 11¼%, making 15% (same).

ASSOCIATED MANGANESE MINES OF SOUTH AFRICA—Final dividend of 50% (12½%), making 75% (25%).

JOHN FOWLER & COMPANY (LEEDS)—Dividend of 10% for the year ended September 30 (25% for the previous nine months).

SHELVOKE & DREWRY—Trading profit for the year ended July 31, £51,545 (£41,596); net profit, after depreciation, etc., £29,990 (£18,838); to taxation, £17,500 (£9,000); depreciation reserve, £2,238 (nil); dividend of 10% (7½%); forward, £33,404 (£34,840).

STEWARTS AND LLOYDS OF SOUTH AFRICA—Manufacturing and trading profit for the year to June 30, £724,015 (£748,461); net profit, after depreciation, taxation, etc., £406,459 (£434,823); to general reserve, £200,000 (same); stock reserve, £50,000 (£66,091); dividend of 10% on increased capital (same); forward, £136,366 (£138,407).

HENRY MEADOWS—Trading profit to August 31, £85,804 (loss, £6,670); balance, after depreciation, tax, etc., £27,516 (deficit, £51,748); to stock provision, £18,924 (£124,500); deferred repairs provision, nil (£10,570); provision for loss on debt in respect goods delivered subsequent to August 31, 1948, nil (£57,766); debit forward, £235,992 (£244,584).